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THE FOUNDRY TRADE JOURNAL,
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BRITISH FOUNDRYMEN'S ASSOCIATION.

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NOTES AND COMMENTS.

Drawing: Its Use to Foundrymen

FOUNDRYMEN, in order to make themselves thoroughly equipped for the various duties which they are asked to undertake in the ordinary course of their work, must make themselves conversant with many subjects of a technical nature. Amongst these we know of none which is of such importance as a knowledge of drawing.

There are certain trades connected with the foundry, such as draughtsmen, pattern-makers, fitters, etc., whose work is largely associated with drawing. It is not to these trades, however, that we wish especially to direct our remarks, as the necessity for a knowledge of drawing in these is at once obvious.

Drawing, however, does not look so apparent as a branch of study which should be pursued by the moulder, but nevertheless it is.

Our observations are written, therefore, with the object of impressing on those engaged in this branch of the trade some of the advantages to be gained by becoming conversant with the principles which underlie this important branch of scientific education.

Drawing may be defined as the language of conveying ideas from one mind to another by the aid of lines, these ideas being of such a nature that they could not, or without great difficulty, be stated in a verbal or written explanation.

To make or understand a drawing does not necessarily imply that one must become a thoroughly qualified draughtsman, yet a knowledge of the subject can best be acquired by practising the art.

Drawing is a subject which cannot be learned by reading books.

The subject is one which covers a very wide field; it has, therefore, been divided into many branches, each of which forms an important study within itself.

A knowledge of some of these branches, although most useful to many engaged in other occupations, would be of little value to moulders.

The Laws of Projection.

The branch of this study which we consider most essential to the moulder is that which teaches him to understand the laws of projection, viz., drawings of objects looked at from different points of view, these representations being known as plans, elevations, sections, etc., each of these views being projected one from the other in such a way that a complete representation of the object is indicated by the lines forming the drawing. Our reason for emphasising this branch of study to moulders is to impress, particularly upon our younger members, the importance which this branch of technical education bears on their future career, and to show to them that if they wish to rise in their profession a knowledge of the subject is indispensable. We should like to see every moulder take a course of instruction in geometry and machine construction; the knowledge of drawing which would thus be acquired, even by an elementary study of the foregoing subjects, would be quite sufficient to make him qualified to master any drawing which he is likely to encounter in the foundry.

Let us see how this knowledge, when acquired, is applicable to foundry work.

A good example is to be found in one of the primary duties of a foreman moulder. To those who are not thoroughly conversant with all the duties of a foreman moulder it might be thought that his duties are confined to allocating the work to the men under his charge, and the supervising of that work during the progress of its manufacture.

Drawing as an Aid to Estimating.

He has another duty, and, in our opinion, one of much importance, that is, estimating for new work.

In all well-regulated foundries, when an inquiry comes from a customer, the requirements of that customer are embodied in a drawing either supplied by the customer or prepared by the foundry draughtsman, and the drawing is presented to the foundry foreman to give a price for producing the article shown in the drawing.

The point we wish to make is, if the moulder cannot "read" the drawing, he cannot correctly estimate for the work, and if he cannot correctly estimate for the work, he is unqualified for his position. In urging the study of this subject upon the moulder, we have his own interest in view; but there is another point to be considered, and that is from his employer's point of view.

We would as strongly urge upon employers to see that their foremen thoroughly understand drawing; for if there is ignorance shown here the work may be over-estimated and the order lost.

Then, again, through the same ignorance, the work may be under-estimated, and a loss on the transaction be the result.

We hope the examples given will be sufficient to illustrate the points to which we wish to direct attention, and that the observations will have the attention of those to whom they are directed.

The Pattern Shop.

The pattern shop is considered by most firms a necessary evil at the best, and is, in too many cases, not given proper consideration in the matter of equipment, light, heat, and room. The only economy in running a pattern shop is in having one of ample size to accommodate the number of men required to run it and the work it is accustomed to turn out, with plenty of light and heat, also good, up-to-date machinery. The majority of shops have the benches placed in such a position as to interfere with the pattern-makers in their work, where there is hardly room to pass each other between the benches. The benches ought to be placed about 6 ft. apart at the least, with a drawing-board placed on trestles in between, running the full length of the benches, and leaving sufficient room to walk along the sides. This method will be seen to give the workman more room for medium-sized and small work. Larger work, of course, can be built up on a floor set apart. The workman who is able to take advantage of machinery is the man who turns out his work in better shape and in considerably less time than the man who is forced to use his physical power, through lack of machinery. With present-day competition the jack plane and rip saw and fast losing their place in the modern pattern shop. First-class wood is absolutely necessary, as is well known to all moulders. Yellow pine is almost universally used in the making of wood patterns, it being well adapted in its nature for such service, being able to stand a fairly good amount of wear and tear, provided it is well taken care of in the foundry. A connection of the pattern shop which ought not to be lost sight of is the storage loft or shed, for, granting that the material is the best obtainable and the workmanship faultless, if the pattern when finished fails

to receive proper care, no one can guarantee for it a long career. Owing to carelessness, a pattern is too often left to knock about the foundry for days, and even weeks, thrown about or left unprotected on the damp sand, whereas if it was wiped dry when the moulder was finished with it and taken to the storage shed, it could be found when required again in good condition. A cover might be provided for all patterns, more especially standard patterns.

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A NEW BOOK ON FOUNDRY PRACTICE.

THE scarcity of good books dealing with foundry practice is so marked that the publication of a new one is an event in the trade. More especially is this the case when such a book bears the name of two distinguished authors—Professor Andrew McWilliam, A.R.S.M., Assistant Professor of Metallurgy in the University of Sheffield; and Mr. Percy Longmuir, the well-known foundry expert.

The new volume, which is published by Messrs. Charles Griffin & Company, Limited, of Exeter Street, Strand, is, like most of the other works which have been issued by that firm, likely to at once take a place amongst the standard technical literature.

The present work extends to something like 400 pages, and is divided into 38 chapters, the first few of which are devoted to such matters as sands, facings, tools, moulding boxes, etc. The authors then proceed to discuss methods of moulding, and take up open sand, green sand, and dry sand moulding. This section of the work is particularly interesting and exhaustive, and goes into detail regarding such matters as moulding from guides, bench, oddside, and plate moulding. Cores come in for due consideration, and also such matters as chill casting. Moulding machines are also dealt with extensively, and several of the better-known types are illustrated.

After fully considering the problem of moulding, the authors come to such practical questions as casting on to other metals, and "burning." They also deal with weighting and binding moulds, and a whole chapter is devoted to the important and often distressing phenomena of shrinking, contraction, and warping.

All foundry foremen will read with interest the chapter on "Faults: Due to Mould and Pattern." The second half of the book—if it may be so termed—is devoted first to a consideration of the physical and chemical properties of malleable, ordinary cast iron, steel, and wrought iron. There are complete analyses given, and also hints as to the methods of selecting irons for particular purposes. Refractory materials come in for a fair share of attention, and the practical construction of furnaces, such as crucible, air, open-hearth, and cupola, is fully discussed.

The question of mixing alloys and of testing the output from a foundry receive a chapter each respectively, and the faults which are due to the metal, as apart from the mould or pattern, are set out in a very instructive form.

The authors state that although primarily intended for foundry managers and foremen, or those who aspire to any such position, they intend that the work shall become as much a companion in literature of the student and apprentice, and we are sure that all who devote their spare time to the study of this book will have no reason to regret it. There is no question that the work is one of the best that is available at the present time.

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DESIRING to improve the estimate of the weight of an iron casting, a stove manufacturer in Cleveland constructed a tank 24 by 36 in., 12 in. deep and graduated the upper 3 in. into sixty-fourths of an inch. When the tank had been levelled up and filled with water to the lower lines of the scale the additional displacement registered by the immersed pattern formed a very accurate measure of its volume, and the weight of the casting was found by multiplying the number of sixty-fourths by four.

MR. JUSTICE EVE, in the Chancery Division of the High Court, has sanctioned the turning of the business of the late Mr. George Fletcher, of the Atlas and Masson Iron Works, Derby, into a limited liability concern, with £85,000 capital, and power to issue £25,000 5 per cent. debentures.

MESSRS. CUNNINGHAM & MORRISON, Balfour House, Finsbury Pavement, London, E.C., have been appointed agents for the South of England for Messrs. G. Anderson & Company, engineers and crane makers, Carnoustie, and also London agents for Grice's Gas Engine Company, Birmingham.

A NEW TAPE AND TICKET PRINTER FOR WEIGHING MACHINES.

In the annexed cut, Fig. 1, a view is given of an appliance which has been put upon the market by Messrs. Samuel Denison & Son, Limited, of Hunslet Foundry, Leeds, for attaching to platform weighing machines and weighbridges. The object is to ensure perfect accuracy in weighing, and to provide a permanent record of the weights passing over the machine. The action is extremely simple. After the weighing operation, the handle shown on the top of the pillar is pulled forward once and put back. This stamps the ticket and the continuous tape at the same moment. A permanent record is thus obtained of the full work done by the machine, either in an hour, a day, or a week. The operator can write on the tape, in line with the weight, the class of material weighed as well as the date and the buyer or seller's name. It will be seen that the apparatus constitutes a valuable check upon the weigh-clerk, and reduces the possibility of error to a minimum. Errors in booking can also be corrected, the whole work of the machine being recorded for any given period. Figs. 2 and 3 give facsimiles respectively of the ticket and tape inscriptions.

Cwts	Qrs	Lb	
18	1	6	Gross DATE ....7/9/07.
7	0	24	Tare NAME ..Saml. Denison & Son Ltd.
11	0	10	Nett MATERIAL ...Weighing Machine...

FIG. 2.—FACSIMILE OF TICKET.

2	2	13	N	6/9/07	Johnson	Bolts
7	0	24	T	7/9/07	Denison	Weighing Mach
5	1	7	T	7/9/07	Scott & Co	Gardens
19	3	25	G	7/9/07	Scott & Co	Gardens
18	1	6	G	7/9/07	Denison	Weighing Mach
6	2	8	T	8/9/07	Henry & Co	Casting
2	0	20	N	8/9/07	Henry & Co	Scrap Iron

FIG 3.—FACSIMILE OF TAPE.

FIG. 1.—A NEW TAPE AND TICKET PRINTING APPLIANCE FOR WEIGHING MACHINES.

CORES, CORE SAND AND CORE-MAKING MACHINERY.*

By G. H. Wadsworth.

A common fallacy among foundrymen is to think that one core mixture will suit a wide range of foundry conditions. Now, the facts of the case are that in a single foundry it may be profitable to have a number of separate and distinct core mixtures, using entirely different grades of core, sand, and binders. From this it is clear that each class of cores must receive separate consideration; and this consideration must cover the core-room, the foundry, and the finishing department portions of the problem. It is necessary on the one hand to take account of what we have to deal with, and on the other what the results are which we hope to achieve.

A Core Defined.

The term core, as it is used by the foundryman, has been defined as a body of sand projecting into an opening left in the mould so as to form a hollow in the casting. Later, however, the term has come to have a broader significance, and the portion of it which we have to deal with covers only such cores as are made by the core-maker and delivered to the moulder for insertion in the mould. In accordance with this we may define a core as a body of sand which is made and baked, and then introduced into a mould, either to form a hollow in the casting or to form one face in the mould, as in the case of covering cores.

Core Constituents.

A core must be porous as to provide a ready passage for the gases as they escape when the metal is being poured about the core. At the same time it must have sufficient strength to resist the wash of the metal. The composition of the core must be such that it will burn brittle when exposed to the metal, so as to crush as the metal shrinks about it, thus relieving the casting from unnecessary strains. This is especially true in the case of cores used for brass and aluminium castings. The core must also burn brittle enough so that it will clean from the casting easily, and in some cases it is important that the surface be of such a nature that it will give a perfectly true, clean, parallel hole, free from rough scale. One great objection to many core mixtures is that they contain material which, when exposed to the heat of the metal, gives off gases which are injurious, or if not, at least troublesome to the moulders, and no matter what advantage binders of this kind may possess, the foundryman will always try to supplant a binder giving trouble from gas by one giving a practically odourless gas. Another point which must be considered is that the core mixture must be cheap; but a cheap mixture may mean a dear casting, and, as stated above, not only the core-room, but the foundry, cleaning-room and machining department should all be taken into consideration when selecting core-room materials. In all core mixtures which come under the scope of this paper, sharp sand forms the principal portion of the body of the core, the remainder of the material being known as the bond. Water in a core mixture only plays the part of an agent for rendering the bond active previous to the baking of the core.

Bonds.

Bonds may be divided into two classes, natural and artificial. The natural bonds practically all belong to the clay class; that is, they are some alumina product. Sand frequently contains a certain amount of alumina or clay, which is frequently known as loam. For some classes of work this forms an efficient core bond, but in the case of brass, aluminium, or grey iron work, it often burns so hard during casting as to make it very difficult to remove the core when the clay is present in large quantities. Some of the modern dry core compounds have pitch for a base, and they also contain powdered coke or other material to cut down the sticky nature of the pitch. Such binders will be found exceedingly useful in the case of large cores, but for machine-made cores dry binders have not proved very successful. The machine-made cores fill the gap between the exceedingly small and delicate cores and the very large cores.

The large cores are rarely wanted in such quantity as to warrant the use of a machine in their production, while the very small cores, and particularly those which are of irregular shape, require special treatment, and when wanted in quantities must be made in metal boxes and frequently provided with carefully-fitted core wires.

A word with regard to such cores may be of interest. In the first place, where these cores have to stand up against quite a body of metal, it is often neces-

* Extract from a paper read at the Lewis Institute.

sary that they be exceedingly stiff. This necessitates the use of core wire. The ordinary annealed iron wire is too soft for this purpose. Some foundries have overcome this difficulty by stretching the wire about 10 per cent. of its length, which hardens it and stiffens it. The same result may be obtained by having the wire passed a certain number of times through the drawing dies after its last annealing. Such wire as this is being manufactured by one firm in the United States. The mixture for these very small cores should be made of good, sharp silica sand, and some very good, strong core binder. The expense per pound of mixture is a consideration which drops out of sight entirely in comparison with the necessity for having strong, accurate cores which can be handled, and which will not fail when the metal strikes them.

Machine-Made Cores.

We will now consider cores known as machine-made cores. The coremachines designed by the author are the result of experiments carried to a successful conclusion to overcome difficulties met in foundry practice which had come under the speaker's observation.

The first machine developed was one to produce cylindrical cores from 1 in. to 1½ in. in diameter. Dies were afterwards fitted to this same machine, which enabled us to make cores to 2¼ in. in diameter and down to ⅜ in. At first it was supposed that only cylindrical cores could be made, on account of the fact that it was observed that the core as it came up from the die always rotated. Later, however, an attempt was made to turn out square cores, and, as this proved successful, many other irregular shapes of prismatic cross-section have been successfully turned out on the standard machine.

It was natural that some foundries would demand larger cores than the first machine could produce, and so a new one was designed, known as the No. 2, which was capable of turning out cores up to 5 in. in diameter. This was successful, and the design was later changed so as to enable it to make cores up to 7 in. in diameter.

When the first machine was brought out it was intended to be operated by hand, but in response to the demand which came from certain customers, power attachments were supplied. When the larger machine was designed, it was intended as a power machine only, but experiments showed that by using a large flywheel it was possible to turn out any size of core by hand, and later there came an enquiry for a machine capable of turning out slab cores, and to meet this demand the multiple spindle core machine was designed, and it has proved very successful indeed.

The next step was, naturally, to use the multiple spindles for turning out several cores in parallel, and a machine of this type is now available. The next demand received was one that at first sight seemed a staggerer. It was for one which should turn out small, square cores, which should not vary more than two 1,000 of an inch above or below the required size; in other words, should be held within four 1,000 in. as the total limit of error.

To accomplish this the multiple spindle principle was used, special dies designed for the purpose, and the cores turned out very satisfactory in all particulars. One point worthy of note is that these core machines could never have been designed and made successful without keeping in very close touch with the work which they were doing. Occasional visits to the factories where they were installed has given opportunity to study the weaknesses and to correct them, and this has resulted in the improvement of the machine and bringing it to its present state of excellence.

Core machine mixtures are an important part of the core machine business. They vary greatly, depending upon the size of the core used and the available material. As in all core mixtures, sharp sand is the base of the mixture. Flour has also been found to be the best binder for most core sands, but it has also been found advantageous to add a small quantity of boiled linseed oil to the mixture.

In the case of very small cores a relatively larger amount of oil and flour is required, and the amount of water used in tempering the mixture must be kept as low as possible, as too much water will cause the sand to pack in the die and block the machine. The larger the die the smaller the amount of bonding material necessary, and the larger quantity of water the mixture can carry.

Recognised Standard Mixtures.

Certain standard mixtures have been developed and recommended as a basis for experiment, but as the core sand used in one district is liable to vary from that used in other districts, the natural bond in the sand will have a varying effect,

and hence the amount of bond to be added must vary to suit. As something to work on in beginning to experiment, the following mixtures are recommended :—

Mixture for Grey Iron for Cores, $\frac{3}{8}$ to $2\frac{1}{4}$ in.

Twelve quarts silica, lake or clear, sharp sand, free from loam or clay.
Two quarts flour.
Half-pint boiled linseed oil.

For Cores, $2\frac{1}{4}$ to 7 in.

Fifteen quarts sharp sand.
Three quarts loam sand.
Three pints flour.
Half-pint boiled linseed oil.

Mixture for Brass and Aluminium Castings.

Four quarts silica or good, sharp sand.
Two quarts brass moulding sand.
Quarter-pint boiled linseed oil.
The more water the mixture will carry the harder and stronger the core will be when baked.

No. 1 Core Mixture for Steel Castings, $\frac{1}{2}$ to $2\frac{1}{4}$ in.

This mixture is used without grinding.
Six quarts silica sand.
One quart flour.
Quarter-pint boiled linseed oil.

Cores, $2\frac{1}{2}$ in. and above.

Eighteen quarts silica sand.
Three quarts fire clay.
One and quarter quarts flour.
Half-pint boiled linseed oil.
These steel mixtures must be very thoroughly mixed by hand when a more suitable way is not available. The fire clay can be increased or decreased according to the hardness of the core produced by the particular sand in use.

No. 2 Mixture for Steel Castings, $\frac{1}{2}$ to $2\frac{1}{4}$ in.

This mixture should be ground thoroughly in a mill.
Six quarts silica sand.
Quarter-pint boiled linseed oil.
One and a-half pints flour.

Cores, $2\frac{1}{2}$ in. and above.

Six quarts silica sand.
Three pints flour.
Quarter-pint boiled linseed oil.
We know that in practice many foundries have departed a long way from these mixtures, but believe that the formulæ given above will serve as a guide in working core machine mixtures.

In some cases all cored holes are bored in the machine shop. Under these circumstances a perfectly smooth hole is not necessary. It is only essential that the core leave the casting readily, and that it does not leave a hard scale in the hole. This may usually be accomplished by the use of a good grade of sand and a moderate amount of flour and oil in the binder.

At this point, however, it may be well to state that flour as sold to the foundryman is not a definite compound, and that many so-called core flours are loaded with plaster of Paris, ground gypsum, etc. Now, these adulterants may or may not have an effect on the scale which the hot iron will form when it strikes the core, but they certainly do have an effect on the bonding properties of the flour, and a few shillings thrown off the price per ton on these heavily-loaded flours may be far more than offset by the reduction in the bonding power of the material; hence, in figuring your core mixtures, it is well to see that you are really using flour.

To return to the subject of machine-made cores, it is of interest to note that with the advent of the core machine many agricultural implement manufacturers have discovered that machine-made cores can produce true, round, parallel holes, which will vary less than one-hundredth of an inch in diameter, and that by the use of suitable blacking on the cores these holes can be cleaned perfectly, so that shafts may be safely run in bearings which are cored to receive them and are given no subsequent machining. In like manner, wheels are run on axles without machine work. In fact, the machine-made core has revolutionised the design of several agricultural implements and those castings in which machine-made cores are used.

Experiments Conducted.

The speaker had carried on a series of experiments with a large variety of core mixtures in the attempt to determine what was best for use in his own foundry, and also in the foundries of many users of his core machines. Some of the materials experimented with have been interesting. For instance, some years ago the black loam from a celery swamp was tried in core mixtures with sharp sand, and it was found that when this was dried and ground, tempered and put through a core machine, it produced a core which left the work readily and gave a remarkably clean hole, and it

may be that some foundryman will find material of this kind good for his particular needs. The vegetable mixture contained in it shrinks in the core oven and gives ample vent to the core, and it burns out in the casting, causing the core to be very rotten indeed. Great care must be taken in baking such cores, as they will burn very easily. It would be probable, however, that it might be difficult to obtain a sufficient supply of this material in most localities.

Before closing the article I believe it will be of interest to speak of the manner in which the mixtures for the large cores used in connection with core boxes in our own foundry are treated at present.

These mixtures were formerly made by hand from a mixture of 50 per cent. new, sharp sand, and 50 per cent. loam sand, with two parts compound. We decided that if the old core sand could be passed through a suitable mill that the bond could be made much more efficient, and the old sand used over, but as we could not find an over-driven mill of the type that suited us, we designed and manufactured one. This was put into operation recently, and to our surprise we find that we can now use 90 per cent. of old sand in the mixture, and that we have been able to cut out the more expensive sand that we formerly used in our core mixture, so that at present we have 90 per cent. old sand and 10 per cent. new, sharp sand, from a local sand bank.

Formerly, we used two parts to the hundred of dry core compound; now we use but one part to the hundred, and a little molasses water. That is to say, it has been found that the dry core compound in the old core prints, and also in the interior of the larger cores, is still active, and when thoroughly incorporated with the new mixture by grinding in the mill, it becomes effective when the core is baked.

The saving effected in labour and materials will pay for the mill in considerably less than a year, and we think others will find it equally advantageous, and hence we have decided to put it on the market with our other foundry specialities.

Baking of Cores.

The subject of core mixtures would not be complete without some treatment of the baking of cores. In the baking of an ordinary core two processes take place. First, the water used as a temporary bond is expelled as vapour; and, second, by the application of a higher heat the permanent bond is made effective. The natural or clay bonds are made effective by drying, for at the temperature of an ordinary core oven these bonds do not vitrify.

Such bonds as linseed oil, corn oil, resin, pitch, etc., become effective by first being made more fluid under the influence of heat, so that they spread rapidly through the sand grains; and, second, by being partially oxidised or changed chemically, so that as the core cools it hardens.

This is particularly true in the case of linseed oil or corn oil. Where flour is used as a binder the hardening process is essentially the same as the making of bread; in other words, through the action of the heat and the expulsion of the moisture, the gluten in the flour is made effective.

An efficient core oven should have the largest possible amount of the space in the oven occupied by cores. To accomplish this in the case of machine-made cores requires a rectangular oven with straight drawers. The drawers should be so designed that the expansion or contraction of the oven will not cause them to bind, and at the same time the drawers should be so arranged that the front of the oven is closed, no matter whether the drawers are pushed back into the oven in baking position or drawn out into the charging position.

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THE following companies are in course of being wound-up:—Aluminium and General Foundry Syndicate, Limited; Britannia Engineering Company, Limited; Railway Rolling Stock Trust, Limited; Solway Engineering and Ship Repairing Company, Limited; Barnard, Bishop & Barnards, Limited; and the Graphic Motor and Engineering Company, Limited.

THE Committee of the Blaenavon Working Men's Institute and Hall, having organised a series of scientific lectures for the purpose of improving the technical education of those interested, were fortunately able to secure the services of Mr. Robert Buchanan, of Birmingham, who delivered a very interesting lecture on "The Constituents of Cast Iron and their Effects," to a fair audience on Monday, January 20. The chair was taken by Mr. Wm. Jones, foundry foreman, who, at the opening, gave a short history of the first blast furnace built at Blaenavon.

HEALTH OF BRASS CASTERS.

MR. WILLIAM WILLS, the Commissioner appointed to enquire into the objections which have been raised by members of the brass foundry trade to the draft regulations which the Home Office made under the provisions of the Factory and Workshops Act, 1901, and proposed to apply to factories where the casting of brass is carried on, heard evidence in the Burgh Court Hall, Glasgow, on the 15th ult. Mr. E. Thornton Lawes represented the Home Office, Mr. A. M. Smith the Engineering Employers' Federation, the Scottish Brass Founders' Association, and the Scottish Coppersmiths' Association; Mr. W. J. Davies the National Society of Amalgamated Brassworkers and Metal Mechanics, Birmingham, and the Scottish Brass Moulders.

MR. JAMES KERR, general secretary of the Scottish Brass Moulders, was the first witness. In reply to Mr. Davies, he said the Society had a membership of 670, all of whom were brass casters. Witness was acquainted with a good few firms in Glasgow and Scotland generally, and had worked with eight or nine. Mr. Davies named a number of firms in Glasgow and other towns in the neighbourhood which cast brass and all sorts of metal, and asked witness if he had seen the process of casting. Witness replied that he had, and described the internal fittings of various shops. Fumes, he said, were created by the pouring of these metals which did not get away. These fumes were injurious to the health of the workers. Many complaints had been received from the men. In some factories the finishing shops were above the casting shop, and the conditions, so far as he was aware, were pretty much the same in Glasgow as in Birmingham. There were different proportions of zinc in the different metals, but these were trade secrets which workmen did not care to divulge. Several firms cast patent metals, and the fumes from these were more injurious than those from yellow brass, owing to the addition of arsenic. Witness had never heard any opposition to the proposed lavatory arrangements, including the provision of towels, and so on. The men were in favour of having these facilities. If hot water and the other things named in the proposed regulations were provided, he was certain the workmen would avail themselves of the facilities for cleaning themselves.

ROBERT MORGAN, president of the Scottish Brassfounders' and Finishers' Employers' Association, was examined by Mr. Smith. He did not think the same regulations should apply indiscriminately to all shops, large and small, well or ill-ventilated, independent of the question of the alloys used in the casting. So far as he was aware, all the foundries had been placed in conformity with the regulations last issued as to washing accommodation. In regard to towels, his men said they would not use them because of the danger of carrying infection. Witness went on to give the proportions of zinc alloy with brass in brazing and bush metal, and said his firm had never any cases of illness among the men caused by the fumes arising from the casting of the brass alloys. Cross-examined by Mr. Lawes, witness said he had had only one case of metal fever in the course of his long experience, and that case was in an earlier foundry than the one now occupied by his firm. His suggestion was that a foundry like his, with so much cubic air space, should be exempted from the regulations requiring artificial means of ventilation. He should say that draughts should begin in a shop where the percentage of zinc used in brass casting was 20. Any foundry below that percentage should be exempted.

MR. STEVEN, of Steven & Struthers, brassfounders, Kelvinhaugh, said he had been in the trade for over 60 years, and he never knew the trouble of brass fever, or ever heard of an employé suffering from it. He had been in all sorts of shops in which all sorts of alloys had been dealt with. Plenty of air space and natural draught was the best ventilation, and he did not know of any mechanical means of ventilation which was superior. He was of opinion that brassfounding shops ought to be thoroughly ventilated. Though washing accommodation was provided, with towels, he never knew of his men using it. If the men had been at all anxious for hot water, that could have been easily supplied. He gave his evidence as a practical brassfounder and as an employer.

JOHN ARTHUR RANKINE, manager of the auxiliary department in John Brown & Company's shipyard at Clydebank, gave evidence as to the perfect clarity of the atmosphere of their foundry within five minutes of a heavy casting. Except for the loam men, the wash-hand basins provided had not been taken advantage of. It would cost between £500 and £600 to provide the lavatory equipment, including hot water, so as to conform with the proposed regulations. The installa-

tion of a fan system of ventilation would cost about £1,500.

Charles Russell Lang, of Messrs. G. & J. Weir, Holm Foundry, Cathcart, gave corroborative evidence as to the absence of trouble among his men owing to lingering fumes. Natural ventilation, such as they had, was the best means. The brassfounders did not even use the lavatory accommodation provided according to the regulations. They simply ignored it. Cakes of soap were at first supplied to each basin, but within half an hour they were all gone. Now the arrangement was that soap could be had for the asking, but nobody asked for it.

The enquiry then concluded for Glasgow. The next meeting will be held in London.

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Messrs. T. Walker and H. Walker, engineers, etc., Bradford, have dissolved partnership.

Mr. B. C. Joy, has started business at Craven House, Kingsway, London, W.C., as an engineer.

Messrs. H. Lewis, H. Lewis, and F. Lewis, engineers, Reading, trading under the style of Henry Lewis & Sons, have dissolved partnership.

WOOD TRIMMING MACHINES.

The accompanying illustrations show one of the most interesting improvements that have recently been made in wood trimming machines. The figures illustrate a vertical balanced fence, which makes it possible to cut any angle between 90 degrees and 45 degrees on timber, up to the full width of the cut in distinction to the depth of the cut, as on other machines, and this is without the use of any attachments. Any compound angle can be obtained by the use of the vertical fence, with its sliding top, in combination with the other fences.

Fig. 1 shows this fence raised to cut

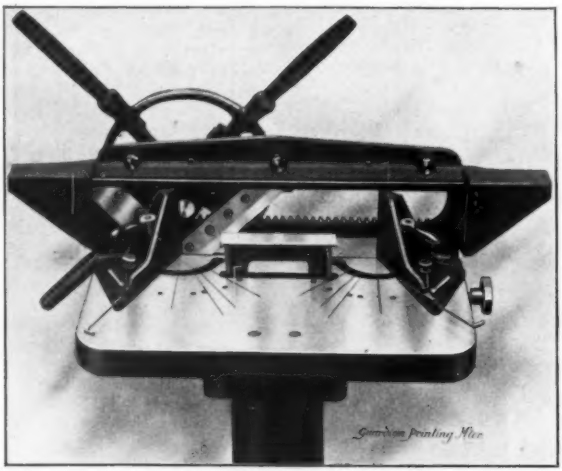

Fig. 1.—View looking down on the Table shewing Rising Fence set to Cut a Mitre.

45 degrees. Fig. 2 illustrates, by a sectional view, how the fence is hinged to get the vertical movement. It is clamped in any position by a screw and handle worked from the operating end of the machine. The ordinary fences have spring-loaded stops, which fit tapered reamed holes, to give various angles from 30 degrees on the inside to 135 degrees on the outside. These fences carry adjustable gauges, which are always in position ready for use as either length or segment gauges. They are shown in Fig. 1. The machine is mounted on a stand, and can be swung round and clamped in any position with the handle shown in Fig. 2. An important

feature in this machine is a simple arrangement to take up wear on the knife carrier. This is done by adjusting the top guide by means of two screws.

The machine also possesses a valuable feature in a constant draw-cut motion, designed to enable the operator to always work at one end of the machine, no matter what fence is being used. This is attained by having a pinion on an eccentric bush on the knife carrier. This pinion climbs either rack that it may be engaged in, and is moved from one to the other by a handle. The eccentric bush is held in position by a spring loaded plug. The operation of changing is practically instantaneous.

The machine is manufactured by the Lumsden Machine Company, Limited, Alexandra Works, Gateshead, to whom we are indebted for the illustrations and particulars given above.

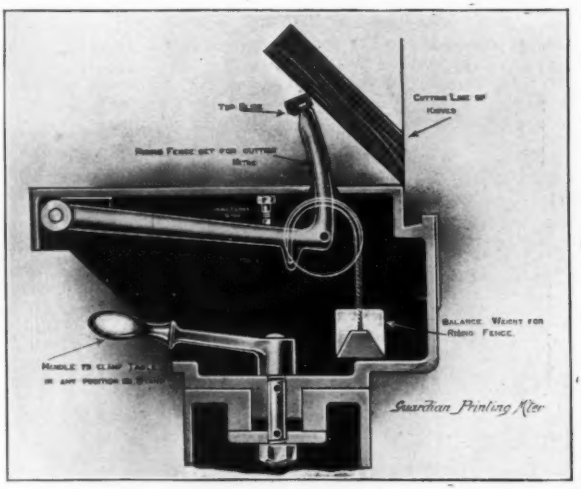

Fig. 2.—Sectional View of Table and Top of Stand.

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Mr. C. Simmons, for some considerable time with Henry Berry & Company, Limited, of Leeds, has now joined the staff of the Brightside Foundry and Engineering Company, Limited, of Sheffield.

SILICON COPPER.

Every foundryman knows the difficulties involved in the manufacture of pure copper castings. This difficulty is due to the fact that cuprous oxide is dissolved in molten copper, and the obvious remedy is to add a reducing agent which reduces the cuprous oxide to metallic copper. Phosphorus has been found to meet this purpose to some extent, but silicon copper is said to be more active in clarifying, refining, hardening, and strengthening copper and its alloys. The reason of the action of silicon copper is that the combination heat of silicon with copper is very high; the silicon therefore takes away quickly the oxygen from the cuprous oxide to form silica. Silicon itself is, of course, unsuitable as an addition; it is, therefore, added in the form of silicon copper.

Some interesting particulars as to this alloy are contained in a pamphlet recently issued by Messrs. J. W. Jackman & Company, who claim that there is no violent ebullition when silicon copper is added to copper or copper-alloys, which cannot be said of phosphorus. The silicon copper can be introduced without the slightest danger of explosion. A pound and a half to two

pounds of silicon copper is required for every 100 lbs. of melted copper in order to produce castings clean, solid, and free from blow holes, swellings, etc. Being placed in the crucible before pouring, a uniform fluidity and an instant reduction of the oxide of copper is assured. This treatment is of great importance for copper used for electrical purposes. Large electrical conductors, so much in demand at this time, can be cast and produced at a far lower figure than if worked or forged from rolled copper.

Silicon copper is also extremely useful in the manufacture of high grade castings in tin-bronze or brass. In tin-bronze mixtures, where there is a large percentage of copper, silicon copper to the extent of from 4 to 8 ozs. only is required to 100 lbs. of the bronze, in order to produce perfect deoxidation. Dulness or sluggishness in brass and tin-bronze mixture is often caused by the gases due to the oxides in the metal. The addition of a very small amount of silicon copper, say from 2 to 4 ozs. per 100 lbs., expels the gases, and reduces the oxides to metal. The fluidity of the mixture is increased to a marked extent, thereby ensuring sharp castings.

Silicon copper is made in ingots weighing about 15 lbs. each. The alloy is exceedingly brittle, and can readily be reduced to small pieces in order to add it to the metal to be treated after the other ingredients are in the crucible. When added to pure copper, the silicon copper should be placed in the crucible just before pouring the molten copper from the furnace. The contents should be stirred thoroughly with a graphite stirring rod and skimmed before pouring.

The average analysis of Messrs. Jackman's copper is as follows:—Silicon, 10.21 per cent.; copper, 89.16 per cent.; iron, 0.34 per cent.; aluminium, 0.15 per cent.

The extreme purity of the silicon copper should be noted.

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Mr. Monte Callow has closed his business at Ipswich, and has joined Messrs. Marples, Leach & Company, engineers, of 6, Victoria Avenue, Bishopsgate Street Without, E.C.

Mr. George Heggie, whose departure from Glasgow for the United States we noted in our December number, and who started work with the Lidgerwood Manufacturing Company of Newark, New Jersey and Brooklyn, New York, has now been promoted to a responsible position with that firm in their extensive works in New Jersey.

PATTERNS FOR REPETITION WORK.

Mr. E. H. Mumford has made the following contribution to the discussion of the paper by E. H. Berry, published in our December issue:—

Mr. Berry, owing probably to exceptional care and skill, as evidenced in this paper, took a set of very difficult patterns and absolutely new moulding machines and installed them in a foundry where the labour conditions were especially adverse, and made a complete success of the installation.

Those of us who know how difficult a thing that is to do, and how many times the attempt meets with failure will appreciate what this paper of Mr. Berry's stands for.

The author speaks of the advantage of a small size of flask. The particular advantage of this, outside of convenience in handling, is the elimination of the risk of sag. If the cope surface sags so that the two surfaces of the mould meet at or near the centre they will surely creep out of match and cause all kind of queer distortions, generally toward the outside edges of the mould joint.

It is stated that the flask must be deeper than the desired depth of the mould. That is true in ramming a bottom board into the mould itself. It is not necessary, where a sand frame holding the excess of unrammed sand is placed over the flask. Mr. Berry illustrates what is to me a very interesting fact. I have found but one man in this country who has made the departure of putting a pattern in the cope and a pattern in the drag and bringing their corners together. The French practice, I understand, has been for years to bring castings placed as these are in the mould into actual contact, so that the corners actually touch. It may seem paradoxical to some; and you will notice in the figure that Mr. Berry has carefully kept his casting about one-sixth of the spacing apart. If you could save this 16 per cent. you would gain so much more room in your flask.

At the last foundry exhibition in Philadelphia, in May, a large number of castings were exhibited, made on the French moulding machine, in which the contact was absolute, and the castings after being poured and cooled adhered to one another until they were broken apart in the mill. The commercial advantage of putting castings edge to edge in a mould is very material.

In this paper there is no mention made of solid cast match-plate, and it is surprising to discover that there are foundrymen who have never seen a solid cast match-plate made in its simplest form. It is not correct to say that you must have a joint surface in your plate that is susceptible of being machined or you must use "open carding." It is possible, and it is current practice, to take the ordinary run of patterns and make a mould in the usual way, and then raise the cope the thickness of the plate you wish to make, closing the cope on a check against which the edges of the match plate will be run of desired shape and dimensions, forming what is virtually a fin in the casting the thickness of the match-plate desired. The only objection to the method is that if the plate is heavy relative to the casting the additional volume of the metal tends to produce a slightly rougher surface. There is a slight burring of the corners, especially on the cope side of the plate, and in match-plates, particularly those made of white metal or aluminium, or bronze. this may be eliminated by running a tool around the corners. There is an advantage in being able to do this tooling; by it you can make the mould joint firmer by taking metal out or burring down the surface at the corner.

This matter of the springing of the match board, or the bottom board, is one of great importance; but there are many other conditions beside the mere distribution of the pressure of the sand which tend to complicate the problem.

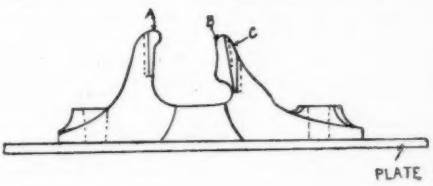
One of the cuts shows a gate in both parts of the mould. In our experience it is not good practice to put such a gate in, unless great care is taken to match it. As a rule, such care is not given, and a slight mis-matching leads to an unsupported corner of sand, which is almost sure to wash and give trouble by carrying dirt into the moulding. Mr. Berry makes a subtle allusion to a very valuable fact, namely, that it is not always machined or finely finished patterns which are the most perfect. There is no better surface for duplicating a casting than one which approximates that of the casting which you wish to produce, and excessive or over-zealous finishing often loses a needed shape or thickness.

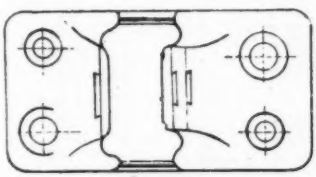
Not long ago I was in a foundry where the stripping plates were of solid iron (no babbitted edges), and the patterns in them were finished like parts of a gun lock. The manager remarked with pride that there was nothing so cheap as money. Yet, in patterns which have cost so much, there is a strong temptation to save the pattern even after a careless finisher has cut too deep somewhere or rounded a corner which had better been left square.

MOULDING RAIL CHAIRS.

By "Pat."

On looking round a modern and up-to-date foundry, and more especially where much repetition work is done, one cannot help but notice the amount of work that is done on machines, and we wonder however we managed to get along before they were introduced. After noting the speed, accuracy, and low cost with which these machines turn out the work, it is hard to conceive that any article of which large quantities are required can be produced cheaper by hand work, or, to be more precise, by plate moulding. That this is so we have only to look around and notice the number of patterns that are still being made by hand-plate work that would otherwise be made on the machine.





Rail Chair.

A notable example of this is to be found in the manufacture of the chairs used on the sleeper of a railway line. There are machines on the market which do this work and without doubt are very ingenious, but so far they are not able to compete with the plate moulder.

These chairs, which vary in shape a little on each railway system, average about 56 lbs. each in weight, and are

something like the form shown in Figs. 1 and 2 (elevation and plan)

It is very essential that the jaws of these castings should be at a certain angle with the base, *i.e.*, one in twenty, and definite size in between for the rail and wedge to fit into. This accuracy is well maintained, insomuch that if they are over $\frac{1}{64}$ in. out they are rejected. This is by the way, and is only mentioned to show how near to size plate moulding can be depended on. As regards the speed at which these are made, two men make between 350 to 400 per day of 9½ hours, the cost for labour being about one half-penny per casting.

Figs. 1 and 2 also show how the pattern is made to draw from the sand. The pieces A, B, and C, are made loose and fit in the pattern by means of dovetails at the back. Iron patterns are used which are fastened to a plate, the two holes at each end being cut out of the pattern so that no cores are required.

The men work in couples; the more experienced one rams up the pattern, and the other rams up the top part on a machined-surfaced plate, and is called a top rammer; he will eventually develop into a chair moulder when a vacancy occurs.

It might interest some of your readers to know that for the chair pattern moulder to earn his day's wage it is necessary for him to lift about 15 tons per day, in addition to using his strength to ram up the mould.

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SPECIFICATIONS FOR IRON AND FUEL, AND METHOD OF TESTING FOUNDRY OUTPUT.*

By R. Moldenke.

Although one often hears of the fine castings produced by the numerous smaller foundries, where specifications and analysis for purchase and sale are disregarded, mention is seldom made of the carloads of castings rejected on account of excessive hardness or internal sponginess. These foundries generally employ standard material, which can be spoiled only through ignorance. In special lines of foundry work, however, and in the large jobbing shops, iron and other supplies are purchased under specification and are subjected to careful inspection.

A comparatively simple set of specifications for all foundry supplies—pig-iron, fuel, fluxes and the newer ferro-alloys—will insure ample results. Since cast-iron is primarily a steel with varying carbon content, carrying large amounts of impurities and mechanically mixed with graphite, it follows that a wide range of metal for casting purposes may be secured by varying the proportions of the impurities and of the combined and free carbon. Thus, a cast iron with but 0.20 per cent. of combined carbon and nearly 4 per cent. of graphite will really be a "twenty" carbon steel, the graphite merely causing the metal to act like cheese under the tool. The addition of steel scrap to the original mixture—thereby reducing the percentage of graphite without materially altering that of the combined carbon—strengthens the metal, which now, however, will not cut so readily under the tool. Proceeding farther, an increase in combined carbon and a reduction in graphite, secured by reducing the silicon, will produce an "eighty" carbon steel, with so little lubrication for the tool as to be too expensive to machine.

In this way, by varying the proportions of combined and free carbon, a wide range of metal is obtained, beginning with the soft, weak, easily machined black iron, rich in graphite, running through the grey and mottled grades, and ending in a hard strong white iron susceptible only to being ground.

Since the relative proportions of combined and free carbon may in a great measure be controlled through the silicon, it is generally sufficient to specify the maximum allowable percentages of sulphur, phosphorus and manganese. Normally blown irons, from reputable blast furnaces, run so uniform in carbon content as to render specification unnecessary. An "off cast" renders itself quickly apparent through the other impurities, and is sold only under its true designation.

For ordinary machinery castings (grey iron) the pig-iron used as part of the charge should contain:

Sulphur, not more than	0.05	per cent.	
Phosphorus, not more than	0.50	,,	,,
Manganese, not more than	0.80	,,	,,
Silicon, from 1.75 per cent. to 2.75		,,	,, as specified.

For malleable castings (white iron) the pig-iron used should contain:

Sulphur, not more than	0.04	per cent.	
Phosphorus, not more than	0.225	,,	,,
Manganese, not more than	0.60	,,	,,
Silicon, from 75 per cent. to 1.50		,,	,, as specified.

A variation of 10 per cent., either way, from the above figures may be allowed.

Where light castings are desired, as for stoves and art work, the phosphorus is

* Presented at the New York Meeting of the American Society of Mechanical Engineers.

specified at 1.00 per cent. and over, and the silicon often as high as 3.25 per cent. Similar specifications may be prepared to cover the rest of the thirteen rather distinct grades of cast-iron, with their more than forty variations.

To enable foundrymen unacquainted with the metallurgy of cast-iron to buy intelligently, the American Society for Testing Materials, through its committee on specifications for foundry iron, prepared schedules designating the composition of the very deceptive, but well known, old grade numbers. Thus No. 1, 2, 3 and 4 are to contain 2.75, 2.25, 1.75 and 1.25 per cent. of silicon, respectively, fracture appearances being disregarded. Sulphur is specified at less than 0.035, 0.045, 0.055 and 0.065 per cent., respectively, when estimated volumetrically, with an allowance of one hundredth more in case the gravimetric method is employed. A variation of 10 per cent. of silicon either way from the above figures is allowed; and the sulphur may vary 0.02 per cent. A deficiency of over 10 and under 20 per cent. does not lead to rejection, but entails a penalty of 4 per cent. in price. This is eminently fair, and protects manufacturer and foundryman alike.

In sampling, each car is taken as a unit, and from this one pig is selected out of each four tons. In case of dispute, a pig is selected from each two tons, the loser paying for the additional labour caused by the closer sampling. Drillings from these pigs taken so as to fairly represent the fracture surface, are to be well mixed before analysis.

It is interesting to note that the liberality of these specifications, appealing as it does to the conservatives, is in direct contrast to the severer requirements of the foundryman who buys by specifications of his own.

Ordinary foundry operations require as fuel anthracite, coke and soft coal, while producer gas, natural gas and oil are employed in the special brass furnaces and in the "open hearth" for steel and hign grade iron. Necessity for specification is confined to bituminous coal and coke, and in the case of the former only the sulphur, and occasionally the ash, demands attention. The increasing use of the air furnace for the manufacture of high grade engine castings is leading to a study of the availability of various soft coals; and the United States Geological Survey, through its advisory board on fuels and structural materials, has gathered much information, so that specifications for coal and coke for melting purposes may be expected soon. In the meantime, it may be stated that no coal containing more than 2 per cent. of sulphur should be used in the foundry, and, preferably, the amount of this impurity should be limited to 1 per cent. Similarly, the ash should be limited to 10 per cent.

The employment of coke demands closer attention to moisture, to the remaining volatile matter, fixed carbon, sulphur, ash, and sometimes phosphorus. Usually, however, the sulphur, ash, and fixed carbon are sufficient to give a fair idea of the value of coke, apart from its physical structure, specific gravity, etc. The advent of by-product coke will necessitate closer attention to moisture. Beehive coke, when shipped in open cars where it absorbs much moisture, may, through inattention, cause the purchase of from 6 to 10 per cent. of water at coke prices.

Concerning sulphur, there is much to be ascertained; whether its sulphates or its volatile compounds get into the iron, and how. Foundry practice, however, has recognised the fact that a very hot running of the cupola results in less sulphur in the iron. In good coke the amount of sulphur should not exceed 1.2 per cent.; but, unfortunately, the percentage often runs as high as 2.00. If the coke has a good structure, an average specific gravity, not over 11 per cent. of ash and over 86 per cent. of fixed carbon, it does not matter much whether it be of the "72-hour" or "24-hour" variety. Departure from the normal composition of a coke of any particular region should place the foundryman on his guard at once, and sometimes the plentiful use of limestone at the right moment may save many castings.

Limestone to be used for fluxing should be as rich as possible in carbonate of lime, for each unit of silica transformed into slag exacts its equivalent of lime and coke. Oyster shells form a most desirable flux, and fluorspar tends to thin the slag.

Use of the modern ferro-alloys will eventually be limited to the richer grades. Even to-day 80 per cent. ferro-manganese is demanded; and, while 50 per cent. ferro-silicon is much used, the 75 per cent. grade, or better, is specified by the wide-awake foundryman. It is wasteful to employ a rich alloy in the cupola; but in the ladle, removed from the further application of heat, the smaller bulk of the richer alloy causes a smaller reduction in the temperature of the molten iron. For the present, specifications are not required for these alloys, which are made from the best material, and should be low in the undesirable elements, sulphur and phosphorus.

In selecting scrap iron, each foundryman chooses worn out or broken castings similar

in composition to the proposed product, so that the addition of this scrap to the pig-iron mixture does not disturb the calculations.

Beyond the exclusion of burnt or very dirty metal, and of sizes so small as to cause waste in melting or too large to enter the charging door, specifications for scrap iron should be limited to a statement of this class of material wanted—machinery, malleable wheels, pipe, etc.

Weak castings and castings with pin holes or with pockets under the skin are indicative of the use of burnt metal. Three hundredths of 1 per cent. of oxygen in solution in the iron as an oxide or combination of oxides is, in the case of white irons, sufficient to ruin them completely. The excessive "skulling" of ladles, and other troubles, can be traced to this cause. Thus oxygen in cast iron is far more powerful than even sulphur; yet the action of the former is little understood, and does not lend itself readily to chemical investigation.

In the matter of moulding sands, American foundry practice is far behind that of Germany, or of the rest of Europe. Until the price of our sands has advanced considerably, we shall continue to wet down and mix with a shovel, instead of grinding and sifting and tempering by mechanical means, as in foreign practice. Careful preparation of the sand before it goes to the moulding floor will insure castings free from surface blemishes. Under present conditions, attempts to introduce specifications for moulding sands are of doubtful value.

The absolute necessity, in the case of a successfully operated steel foundry, for the application of specification to all supplies purchased is so well understood that the steel foundry is usually classed with the steel mill, and apart from the foundry. If the acid process is used, or the Bessemer converter, the metal used is a "fancy" pig-iron containing practically only iron, carbon, and the proper manganese and silicon. The basic process allows the use of cheaper material.

The characteristics of the finished product are determined either by testing each article, or by testing to destruction an occasional sample, or by the use of test bars.

If the establishment makes finished specialities in iron, ease in machining is the important requirement, and an estimate of this quality may be gained by placing an occasional cast sample disc in the lathe or drill press, the nature of the tests being dictated by the experience of each shop.

Ordinary commercial castings, on the other hand, must be subjected to additional tests; boiler sections, to determine their resistance to pressure; valves, to ascertain whether they are tight or not. Castings produced in very large quantity must be tested to destruction, by sample, which, of course, is far beyond the limits of actual service conditions. The remarkable quality of car wheels has resulted from this exacting system of testing.

The foundryman, however competent, is dependent upon the quality of the iron for the production of serviceable castings. It is necessary, therefore, in the many cases to which testing to destruction is inapplicable, to make a test of a sample form composed of iron identical with that in the casting. To-day in foundry practice the foundryman may employ shop test bars of such size and shape as he chooses. Comparison of the performance of his test bar with that of the purchaser's test bar will enable the experienced foundryman to determine the degree of exactness with which he is meeting the requirements.

Finding that such a variety of standards prevailed, the American Foundrymen's Association and the American Society for Testing Materials, under separate action, but by individual members of each committee, have adopted a set of specifications which embodies the last word on this complex subject. These specifications depart entirely from established procedure.

It has been attempted in these specifications to avoid the introduction of outside influences as far as practicable, and to have the sample represent accurately the iron as it comes from the cupola or the furnace. Hence, the round sample bar is to be of as large size as the limits of commercial testing machines will permit, it is to be poured in a vertical position to avoid the difference of strength between top and bottom if poured horizontally; and the mould is to be dried to ward off the effect of damp sand. The speed of testing is specified, and a regular routine of pouring is to be observed. At the suggestion of Mr. Walter Wood, this bar is called the "arbitration bar," as it is intended for use only in case of dispute between buyer and seller.

The new method of testing, as adopted by the American Society for Testing Materials, is being generally used, and is found to be far superior to the old custom of flat, square bars of small cross section, or the long bars so susceptible of dishonest manipulation. The transverse is best suited to the peculiar nature of cast iron; but an optional tensile test is provided for, at the cost of the party demand-

ing it, although in Germany this latter test is excluded altogether. For further details the reader is referred to the publications of the two societies mentioned heretofore.

The ethics of the cast iron industry has been dependent upon the better understanding of its metallurgy. In times past the foundryman refused orders to which specifications were attached; and he refused even to provide tentative specifications which might enable the buyer to obtain such iron as he desired to purchase. Now this is changed, and the progressive foundryman welcomes inspection of his methods and tests of his product.

It is to the lasting credit of the foundry that the first demand for specifications came from the foundrymen themselves, through their Association, and that they co-operated heartily with the engineer by furnishing information, freely and without reserve. A very friendly feeling between buyer and seller has ensued; for no better evidence of good faith can be given than an invitation to visit freely the shops and the laboratory to inspect manufacture and test. This is the rule to-day, not the exception.

CORRESPONDENCE AND QUERIES.

Edited by C. E. ALLEN.

(Replies to queries in this column will be gladly received).

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Having a large number of gas-engine pistons to make, varying in length from 12 in. to 15 in. and 5 in. to 9 in. diameter, with which I am experiencing considerable trouble, and being a constant reader of your journal, I should esteem it a favour if you or some of your readers could advise me through your columns as to the best method of economically producing such castings; also if it would be possible to mould them expeditiously on a machine, and what kind of machine would be most suitable. I have run them with two small ingates at the bottom, and also with two large ingates in the side half-way down. I have had good hot metal each time, but cannot get them perfect. It is either some dross or small blow-holes. Trusting I may not be asking too much,

I beg to remain,

Yours, etc.,

"PISTON."

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,— I have a quantity of name plates to make, similar to those used for branding dies, etc., to cast in brass or gun-metal. There is a lot of detail on them, and Mansfield sand appears too coarse. I should, therefore, be much obliged if yourself or some of your readers could inform me which would be the best way to mould them, and what sand to use, etc., to produce a fine surface, and at the same time make a first-class job of them. Thanking you in anticipation,

Yours truly.

"SURFACE."

LYCOPODIUM.—Could you, or any of your readers, tell me of an English maker of lycopodium, or a good substitute.—W.H.

MELTING FINE TURNINGS.

I have just read Mr. C. E. Allen's reply to my question *re* "The Melting of Fine Turnings," and find that he has quite failed to see the real point of my query. What I wanted was, not how to melt brass, gun metal, copper, or other ordinary turnings from metals, but how to deal with the turnings and filings of a special alloy as stated, viz., an alloy composed of a large percentage of zinc, a little aluminium and a small proportion of iron.

My trouble all relates to this special alloy only. It is, undoubtedly, the presence of aluminium in finely divided particles mixed with the other metal, which causes the difficulty in reducing the metal into the fluid state. The well-known great affinity of aluminium for oxygen, apparently taking effect as soon as the turnings are heated, when the whole mass is quickly oxidised. Now what I want is some method of preventing this oxidisation, and to enable me to reduce the metal into ingots.

As the matter is rather urgent, and I am being pressed by my employers to find a way of using up this apparently waste metal, I should be glad if you could give me some help in the matter.

(A READER FROM THE BEGINNING.)

In further reply to "Reader from the Beginning," I must admit that I quite overlooked the point in his query, viz. :—

That it was a special alloy composed of zinc, aluminium, and iron only. Now, special alloys require special treatment; in the first place, aluminium and zinc alloys are obtained by first melting the aluminium and then adding the zinc in small pieces, and proportions of the latter up to 33 per cent. are used. Your trouble, in my opinion, does not arise through the aluminium, but through the presence of the iron; the possibility of uniting zinc and iron, was, and is still, a subject of doubt and dispute amongst chemists. It is, indeed, easy to understand that two bodies would not readily combine, one of which is somewhat volatile and the other very refractory, and if we melt them together the zinc volatilises at a white heat and pure iron remains. But at a moderate temperature the alloy may be effected to do this, we must bring the iron to a red heat (with small charcoal), and up to the point of fusion, and then add to it the zinc, or by heating together to a red heat for some time in a hermetically-closed vessel, the temperature at which zinc fuses—a dull red heat—is the best. You will therefore see that an alloy of zinc and iron cannot be effected, except by means of some very nice precautions. And in conclusion let me add that it is essential that all the iron turnings which, in my opinion, have become mixed with the zinc and aluminium in the machine shop, shall be entirely removed, because in the event of your reducing the zinc and aluminium to a fluid state, the iron contained therein would cause it to be hard and pinny. These, if such is the case, can be removed in a magnetic separator, or by passing a row of magnets repeatedly through the mixture until the magnets cease to take up any more iron, then reduce to ingot the zinc and aluminium, after dipping in paraffin or turpentine, in order to cleanse it from dirt and grease. Some small scrap is usually added, as this prevents loss by drossing, and as the aluminium has a great tendency to absorb gases during melting, only good plumbago crucibles should be used. It is as well to cover the metal with a thin layer of carbon, and in every case it is well to use a plumbago cover or lid to the pot.

—o—

THE CITY OF LONDON WOOD-WOOL COMPANY, of the Plover Works, Hackney Wick, N.E., have been successful in securing the renewal of their contract for the supply of "Elastene" wood-fibre to H.M. Post Office.

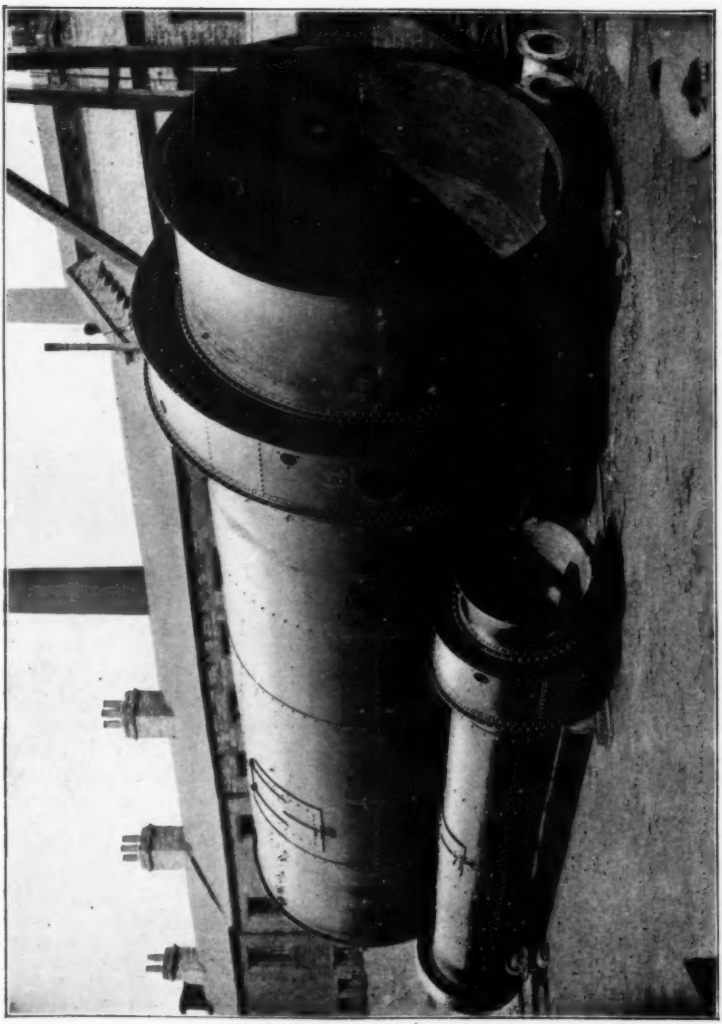
NEW FOUNDRY CUPOLAS.

WITH the cost of fuel pressing more and more hardly upon the ironfounder, threatening in many cases to wipe out his margin of profit completely, it is fast becoming a matter of the utmost necessity for him to keep a keen look-out for any and every means that will enable him to effect an economy in his coke consumption. Everyone now recognises the importance of utilising to the very best advantage every pound of coal thrown into a boiler fire, by putting down suitable economising plant, and iron-founders are no less obliged than anybody else to husband their fuel resources. Undoubtedly there is a great deal of wastage in this direction going on in most foundries. How many are melting their iron with a fuel ratio of 8 per cent. of the iron melted? Yet this, instead of being an exception among a few, ought to be a general rule with the many.

We give an illustration (Fig. 1) of two of the latest cupolas placed on the market. The small one (2 ft. 4 in. diameter shell) melts up to 1 ton, and the large one (8 ft. diameter shell) up to 15 tons of metal per hour. The makers, Messrs. George Green & Company, engineers, Keighley, contend that their cupola will pay for itself by the end of the first few months' working. An advantage possessed by these cupolas is that the same blower hitherto in use can be utilised, and yet the time taken to blow be reduced by fully one-half. In foundries where the rule has been to tap the first metal two hours before the usual closing time, it has been found that with the "Economic" cupola, using the same blast as with the old cupola, but with less coke, it is quite soon enough to tap the first metal one hour later, and yet finish blowing before the usual closing time. An extra hour a day is thus given to the moulder.

—o—

R. B. TENNENT, LIMITED, Whifflet Foundry, Coatbridge, signalised the close of their last year's work in a successful casting for the Clyde Bridge Steel Company, Limited, Cambuslang, of the second of a pair of the largest steel plate rolls ever manufactured in this country. The rolls measure 13 ft. 6 in. long in the body by 40 in. in diameter. Over 50 tons of mild steel were used, and the molten metal was run from the furnace to the mould in the short time of 8 minutes.



NEW FOUNDRY CUPOLAS—A CONTRAST IN SIZES.

SOME FOUNDRY EXPERIENCES.*

By A. R. Bellamy (Stockport).

Whilst papers on the smallest detail of engine or machine construction are quite in evidence, and improvements in the rate of cutting metals and machine shop economies have had much consideration, founding, which must be admitted to be the foundation of engineering industry, and which can effect more economies than any other branch, has received but scant consideration. The result of this neglect is that the literature of the trade is limited, and many of the present methods are practically the same as those of 40 years ago.

In the hope that this paper may be the forerunner of many others on foundry work, it is proposed to open out the subject under the following heads. (1) Whether a foundry can be successfully managed as part of a manufacturing engineering business. (2) What determines the decision to build a foundry:—(*a*) Control of the foundry facilitates obtaining a regular supply of good castings; (*b*) reduction in cost of castings; (*c*) improving the castings; (*d*) general convenience in having the foundry in close touch with the rest of the works; (*e*) obtaining greater secrecy. (3) Having decided to build the foundry, the points to be considered are:—(*a*) The site to be chosen in relation to the works and the surroundings; (*b*) design of building; (*c*) management and division of labour; (*d*) power and light; (*e*) equipment; (*f*) foundry accounts and cost of production.

(1).—Whether a Foundry can be Successfully Managed as Part of a Manufacturing Engineering Business.

As a rule a foundry is the part of an engineer's business about which he knows least, and it is the part in which the personal equation counts for more than in almost any other department. It has been the practice in engineering from its commencement for foundries to be run as independent businesses, and one would therefore naturally conclude that there must have been some important consideration that led to this development. It might well be argued that the founder's art is one requiring so much personal attention that success could only be obtained by devoting to it the entire attention of the heads of the firm, who themselves would need to be practical foundrymen.

Undoubtedly there is a good deal of risk in the foundry business, and skilled management is certainly required, and it might, therefore, be considered that an engineer tendering for contracts and basing his price for the work on the assumption that he would obtain good materials, would, by buying his castings, lessen his risk. It could be argued that castings were, after all, raw materials, like forgings, bar, iron and steel, and the production of them was outside the province of an engineering works.

If, however, in spite of these statements it be admitted that there are no positive reasons why a foundry should not form a beneficial part of an engineering business, and that, even as a man does not need to be a first rate turner in order to manage a machine shop, so it is not necessary for him to be an expert moulder to run a foundry; then

(2).—What Determines the Decision to Build a Foundry.

a. Control of the Foundry facilitates obtaining a supply of good Castings.—Everyone who has had anything to do with the management of an engineering factory knows the importance of getting the materials ready well ahead of the machine shop, and how provoking and wasteful it is when certain parts are lagging behind the rest. Very often some of the castings are short, and it requires much care and watchfulness to prevent this. It may be generally noticed that the castings which make weight are delivered quickly and regularly, but the difficult and light parts are invariably behindhand. The peace of mind of the management is not increased by finding a large piece of work, worth hundreds of pounds, waiting the arrival of a casting worth a few shillings. It does not necessarily follow that such omissions will not occur in the works foundry, but there is certainly very much less likelihood of it happening, and if it should happen the omission is more rapidly made good. Again, the stock of castings in the foundry stores can be more closely regulated, and the system of maximum and minimum stocks introduced, which would often be impracticable without the works foundry.

While on the subject of the supply of castings, it may be of interest to state that the specific foundry dealt with in this article has an area of 1,642 square yards available for moulding, and that about 3,500 tons of castings were produced

* From a Paper read before the Manchester Association of Engineers on November 9, 1907.

last year, being 2.1 tons per square yard per year. As, however, the foundry is not yet delivering its full quantity, this can only be taken as an approximate figure.

b. Reduction in the Cost of the Castings.—It might be laid down as a fairly safe rule that where large quantities of general engineer's castings are required, and where there is a good deal of repetition work, then the foundry attached to the factory and specially designed for such work will produce the castings at a price considerably lower than they can be obtained from outside. The outside foundry cannot, and will not, devote so much attention or expend the amount of money necessary for all the many appliances that save money in such cases, as they are bound to remember that their contract is only of short duration, probably for a year, and may be cancelled at the end of any such period, rendering useless their outlay on the special appliances to suit the special work.

Presuming the castings required are not of the repetition order, and that they alter fairly considerably in size and design from day to day, then the problem of reducing the cost becomes more difficult, and a very important consideration is, whether the quantity is such as will permit of production at a low price. If accurate statistics could be obtained, a chart might be prepared, giving the weight of iron necessary to be melted each working week for any class of castings, to make the cost of production equal an average market price for similar castings. It may be accepted that to compete in cost against outside foundries, it is necessary to turn out a certain tonnage per week. The amount of the tonnage varies with the class of the castings, and it is the accurate determining of this quantity that ensures success or foredooms failure in the cost of production. An item which must not be lost sight of is the weight of the castings.

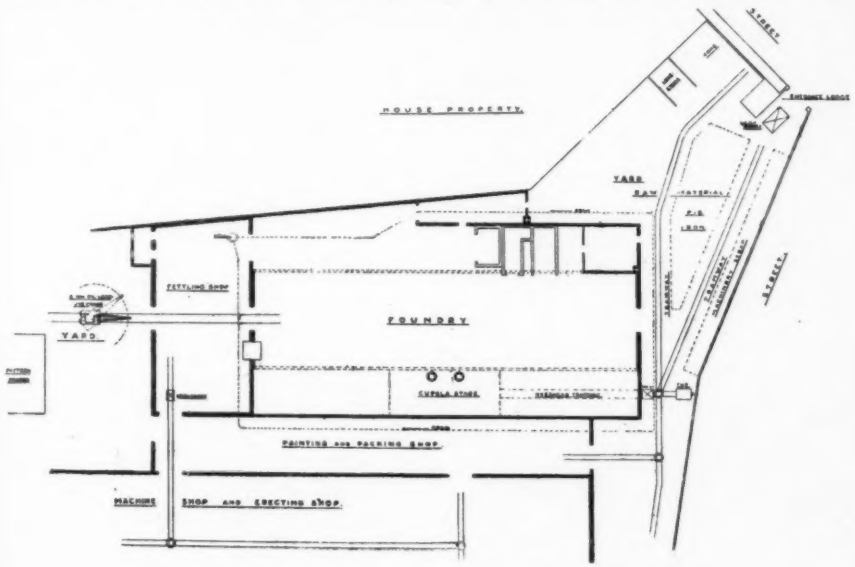


FIG 1.—KEY PLAN OF FOUNDRY AND SURROUNDINGS.

The practice of rubbing the cores is an old grievance. Very often the calculated weight and the actual weight vary considerably, and a good profit may often be made on the saving in weight, a matter which can be more closely watched and dealt with in the works foundry, where there is not the same temptation to unduly increase the weight of the castings. Another point of importance is the advantage of being able to make purchases to suit market conditions, and to buy large quantities of raw materials well ahead, if the prices be favourable.

c. Improving the Castings.—It may

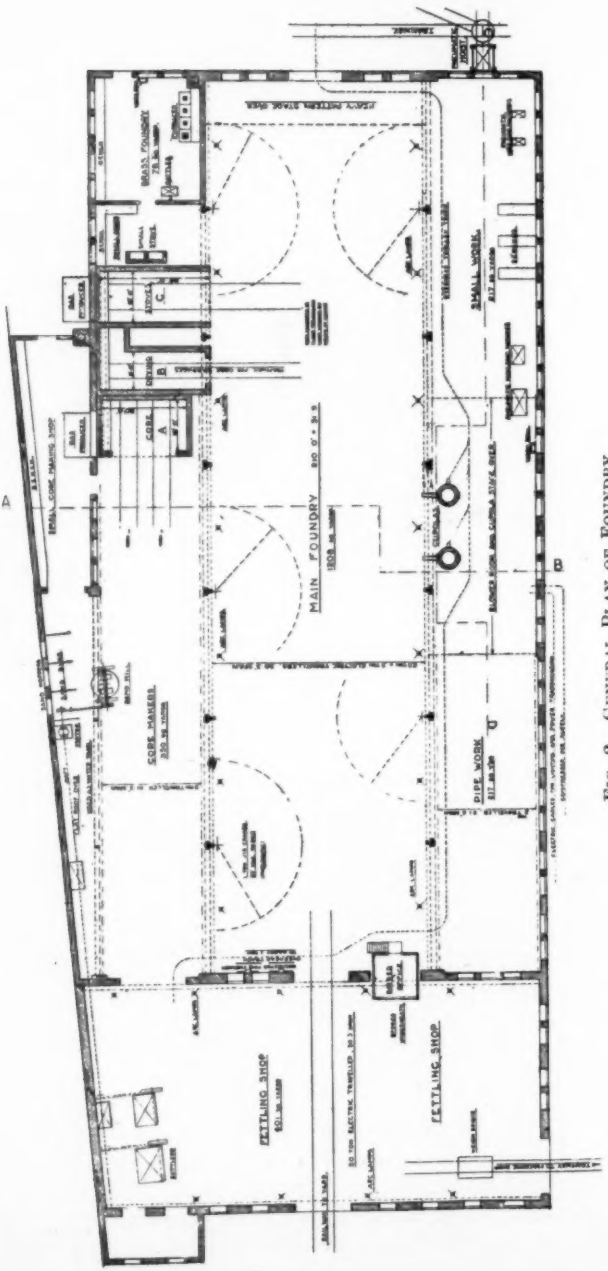
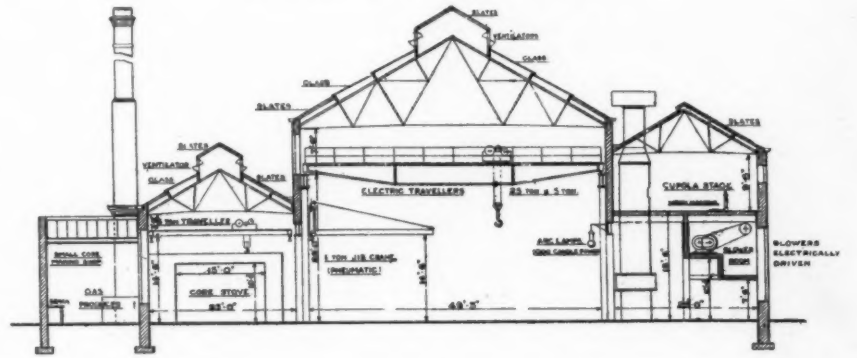


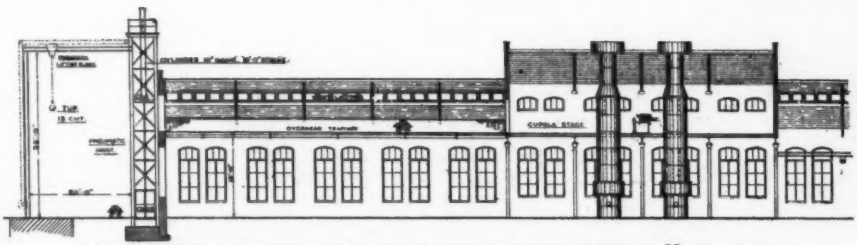
FIG. 2.—GENERAL PLAN OF FOUNDRY.

happen that whilst sufficient castings can be procured outside, the quality is unsatisfactory. There is little doubt but that the quality of the castings can be made more suitable for their purpose in the works foundry. There is a better co-operation between the designer, the pattern-maker, the foundry foreman, and the works manager. Further, the supervision of the purchase of raw materials being in the hands of the management, a better selection can be made to suit any pleasure to the designer and to the commercial men of the business.

d. General convenience in having the Foundry in close touch with the rest of the Works.—Quite apart from the regulation of the supply of castings, there are some other important advantages in being in close touch with the foundry. The patterns can be watched more closely, repairs can be more promptly made, and the patterns kept in better condition. Outside foundries are often sore on the patterns,

CROSS SECTION ON LINE A.B. (FIG. 2).





LONGITUDINAL SECTION SHOWING COMMUNICATION BETWEEN YARD AND CUPOLA STAGE BY MEANS OF HOIST AND TRAMWAY.
FIG. 3.

special requirements. This question of quality is a most important one, bearing as it does upon the cost of machining the casting, and the general appearance of the finished articles when completed. The engineering manufacturer is well aware of the necessary dressing, filling in, rubbing down, painting and varnishing which are necessary to give a satisfactory appearance to his goods, and the slow and costly process it becomes. However well it may be done, no painter can fill in and finish off badly moulded castings, and give the nice clean lines of design which give a and this is due to the want of a little mending in time. Designs can be simplified and improved by watching the progress of the work in the foundry.

It is sometimes difficult to see clearly how the casting is going to look by examining the pattern, and it is a great advantage to have the head pattern-maker in conference with the foreman moulder when new patterns are being put in the sand for the first time. Such conferences often enable small unimportant changes of design to be made, which much simplify the moulding, and thus lower the cost of

production. The drawing office also has the advantage of seeing the work more in progress, and can correct and improve its work with less delay and cost.

e. Obtaining Greater Secrecy.—Without casting the slightest reflection on the outside foundry, it is obvious that the same secrecy cannot be maintained when the castings are procured from outside.

(3).—Points to Consider after Deciding to Build a Foundry.

a. The Site to be chosen in relation to the Works and the Surroundings.—The nature of the ground upon which it is proposed to build must be considered. The land must be as free as possible from water, otherwise there will be trouble in keeping it out of the floor. If there be any danger of water coming in from the surrounding land it is best to enclose the whole foundry by a drain.

The foundry should be placed with spacious open yards at both ends if possible, and the general plan be for all raw material to be delivered in the yard at one end, either by road or rail, and all finished castings to be despatched from the other. The point of delivery should be convenient and handy for the foundry stores and machine shops. It is desirable to place the foundry so that its least objectionable side abuts any neighbouring property, and for this reason the cupolas, charging stage, blower room and power house, should be placed on the side furthest from the adjoining property, as there is a danger of receiving complaints of dirt and smoke from the cupola and noise from the blower room and power house.

b. Design of Building.—Judging by a large number of foundries, this question does not appear to have received due consideration. At best, the foundry is a dirty place, and, therefore, the building should have greater consideration rather than less. For general engineering work, a portion of the foundry is required for heavy work, and the remainder for light castings. To be able to deal conveniently with the heavy work the building should have ample head room, and be constructed with due regard to the strains arising from lifting heavy weights.

Possibly the best design for most foundries producing heavy and light castings, is to have one or more middle bays, the roofs of which are supported on built-up steel stanchions, which also support the crane rails. Further bays of a lighter design can be arranged at each side for the small castings, bench moulding, core making, etc. Whether the whole building should be constructed as a skeleton in steel work, having the sides and ends filled in with light brickwork or other material, or whether the outer walls should be of substantial brickwork with only steel stanchions in the middle bay or bays is a matter of opinion. It will probably be found that the first-named design will be more costly to construct, and the balance of advantages would appear to lie with the latter design.

The foundry taken as an illustration in this paper, if not of the very best design, has proved very satisfactory and convenient. The cost of the foundry, exclusive of core stoves, pot furnaces, floor sand and cupolas, worked out at about 2d. per cubic foot of contents, and the fettling shop 1.4d. per cubic foot. The foundry has a slate and glass roof with extensive ventilators, and has three lines of girders and crane rails. The fettling shop has a "Belfast" roof with a certain number of ventilators and roof lights, and one side wall is formed by the end of the foundry. The floor of the middle bay is covered with sand to a depth of about 2 ft. There are no moulding pits, as most of the work is done in boxes. It is a good plan to have a number of anchor bolts fixed in the floor for bolting down top boxes, thus avoiding the use of heavy weights, which are cumbersome and inconvenient.

In this foundry the charging platform is completely enclosed and roofed in like an upper room, but is amply ventilated. It is, therefore, entirely protected from the weather. The charging floor is formed of steel plates resting on substantial steel girders and joists, and will store sufficient materials to last ten working days. The walls of the foundry are pierced with a large number of windows, and there is a good deal of glass in the roof, the result being that under ordinary conditions this gives the foundry a well-lighted appearance. Foundries have a tendency to be dark, the floor being chiefly black reflects little light, and, although many windows may require much cleaning, the advantage of light is well worth the expense.

c. Management and Division of Labour.—This is a debatable question. It is possibly the best plan to have a head foreman who has complete charge of the foundry under the supervision of the works manager. The appointment of the under-foreman should be left largely to the discretion of the head foreman, and he should be consulted upon all materials required for the foundry, such as the best brands of iron to be used, quality of coke, etc., it

being understood that he is held responsible for the quality of the metal in the finished castings. Whether this arrangement can be improved upon by the introduction of a metallurgical chemist is a matter for consideration.

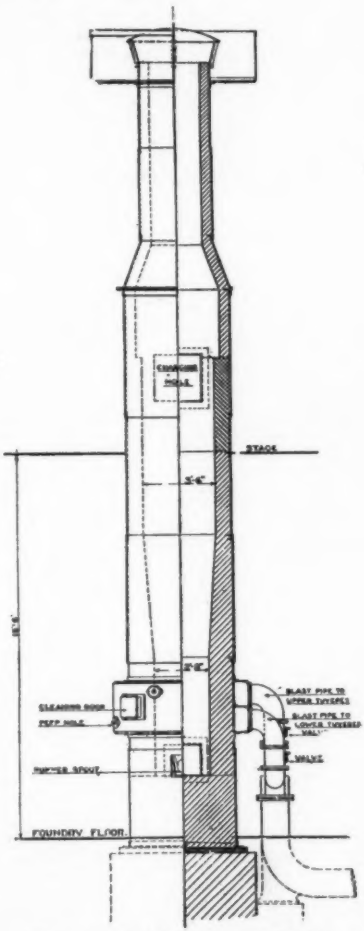


FIG. 4.—ELEVATION OF CUPOLA: HALF IN SECTION.

In some foundries a chemist has been appointed whose duty it has been to take charge of the cupolas, the mixing of the irons, and to deliver to the foundry foreman the quantity of metal he requires in a molten state at the hour decided upon. This chemist has a laboratory placed in juxtaposition to the charging stage for the purpose of analysing all the materials used in the cupola. With this knowledge he is able to make his mixtures to suit any quality of metal required, and to do this by using cheaper grades of irons, mixing

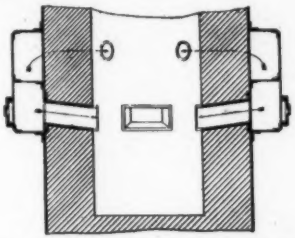


FIG. 5.—VERTICAL SECTION THROUGH AIR BELT, SHOWING TUYERES AND SIGHT HOLES.

one brand with another to correct and improve the quality as required. The system has much to recommend it, and the extra expense is many times recouped in the saving of cost in the purchase of raw materials. So long as everything is going on all right, the works manager has no difficulty, but when the "wasters" appear, then trouble commences. Who is responsible for the bad work? However much care is taken to investigate the occurrence by a rational and practical enquiry, it will be found most difficult to avoid "friction" developing between the

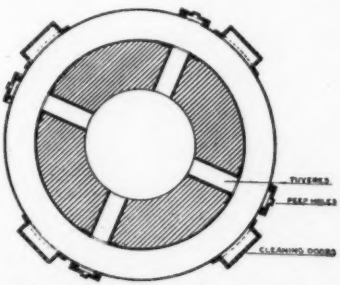


FIG. 6.—SECTIONAL PLAN THROUGH AIR BELT, SHOWING UPPER TUYERES AND CLEANING DOORS.

foreman and the chemist, especially if the foreman is paid a premium or bonus on the foundry results. The "friction" will increase as the "wasters" multiply, and the final result will be that there will be a change made, either in the person of the foreman or the chemist, or both. Dual

responsibility of this character is never satisfactory.

Possibly the best method to obtain the advantage of this system of working the foundry would be to have a foundry manager who would take complete control, and he would appoint and direct the chemist and the foundry foreman. When any "wasters" turned up he would decide the cause and deal with it accordingly. It would be necessary for the manager to have the theoretical knowledge of the chemist and the practical experience of a foreman. But, unfortunately, the foundry has never possessed any attractions to the mass of engineering students, and has, as a rule, been left out of the works curriculum, and therefore it is most difficult to obtain the type of foundry manager required. Unless such a manager is in charge it would appear that the advantages of having a chemist are very doubtful, although one is reluctant to forego his services if by his assistance cheaper brands of pig-iron can be used, and the quality of the molten metal can be relied upon to suit all purposes.

It has been usual for the moulder after closing up the mould to pour his metal, but it is considered by some experienced foundry managers that it is unnecessary to employ a skilled moulder to do this, and that it is better done by having a number of special handy men for the purpose. The practice has, however, not come into general use, partly because the moulder is generally held responsible until the casting has been made, and partly that it is the custom of the trade for the moulder to do his own pouring. Again, it is not often convenient to give a moulder another piece of work just about casting time, and if the jobs are large there may not be sufficient floor space available. For small work there is no reason why the special men should not be employed. The question is one well worth consideration and an interchange of opinions.

d. Power and Light.—If it can be arranged for the foundry to have a supply of power from the works, and to be relieved from the trouble of its own motive power, that will probably be found the most convenient arrangement. The amount of power required in the foundry varies very much at different periods of the day. In the afternoon, when the blower or fan is at work, and all the cranes are busy, the load is heavy, especially in the winter months if the electric light is installed. The foundry requires energy in many forms. It would be difficult and inconvenient to arrange to drive everything in a foundry direct from shafting. Electric power will be found very serviceable and handy for a number of purposes apart from the travelling cranes. Electric energy will not, however, be the best for every purpose. If moulding machines are used, compressed air or hydraulic power is necessary. Hydraulic power can be usefully applied to many purposes, and therefore it may be desirable to have electric energy, compressed air, and hydraulic power. Possibly, it will be found that by using electricity and compressed air all the various appliances in the foundry can be simply, economically and effectively operated.

As most modern engineering works have now both electric current and compressed

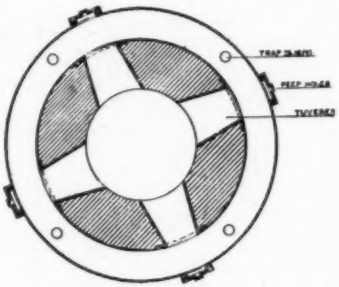


FIG. 7.—SECTIONAL PLAN THROUGH AIR BELT, SHOWING LOWER TUYERES.

air installations, it can often be arranged to supply the foundry from the works power station, charging the foundry for such power on a fair basis. Compressed air will be found very serviceable for blowing out the moulds, and for blowing off the dirt when cleaning the cranes and other appliances. It may be argued that hydraulic power is best for some purposes, such as moulding machines, jib cranes, and the platform hoist, by reason of a steadier motion, but the question is whether the advantages to be gained by the hydraulic power are worth the expense of the installation.

A foundry is a very difficult place to light effectively, and all forms of artificial light have their disadvantages. Gas lighting with ordinary burners is very inefficient, and the incandescent gas mantle soon becomes choked with dirt. The arc lamp does not show to advantage in the atmosphere of the foundry at the time of casting. Incandescent lamps burning oil

under pressure are often used, but possibly, all things considered, the powerful yellow light from certain arc lamps succeeds the best. The lamps should be placed along the bays and fairly high up. These lamps must be frequently cleaned, and must have systematic attention.

e. Equipment.—In the appendix will be found a list of the appliances which have been installed in the foundry illustrated in Figs. 1, 2, and 3. This list does not cover what may be considered as the whole of the equipment necessary in such a foundry, but it serves as a guide, and shows that the requirements of a foundry are fairly considerable.

FIG. 8.—INTERIOR OF FOUNDRY.

Fig. 4 shows a sectional elevation of the type of cupola which was selected after careful consideration and after inspecting a number of various designs at work. It will be noticed that there is no receiver, and that the cupola has a solid bottom. The only advantage in the "drop bottom" is the ease and speed of emptying the cupola at the end of the cast. Against this advantage must be set the risk of the bottom giving way through being imperfectly closed, or due to wear. The labour of cleaning out the cupola through the "making-up" door is considerable, but the materials can be distributed over a larger area on the floor and placed in a more convenient position for wheeling away after being "slacked down." The drop bottom also requires more labour in making the cupola bottom good each day than the solid bottom. For certain classes of work the receiver may be found beneficial, but in a general way it has no advantage, and there is trouble and expense in its maintenance. When the cupolas were first started the air from the blower was discharged by two pipes into the top and bottom of the air belt, as shown in Fig. 5. This belt was divided into two compartments, so that the air was discharged through two series of tuyeres, one over the other, was independent, and could be controlled with wing valves in the supply pipe. Fig. 6 shows the tuyeres as first tried in two rows of four parallel ports, giving a total area of 79 square inches for each set, and an air velocity of 11,000 ft. per minute, with an air pressure of about 35 in. of water. With this arrangement the top series was put into use when commencing to blow. When the metal began to melt the bottom series was opened, and the top set reduced or shut off.

Difficulty was experienced due to bridging, and also the coke consumption was excessive, ranging from $2\frac{1}{2}$ to 3 cwts. of coke per ton of iron. The slag which first collected round the mouth of the tuyeres followed the air current until in some cases it bridged right across. On account of this difficulty the direction of the current was altered by placing tuyeres at a

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tangent, so that the entering air would whirl round, but the results remained much about the same. Finally, it was arranged to introduce the air at the bottom and at a lower pressure, and a much reduced velocity.

The alterations made to the bottom row of tuyeres are shown in Fig. 7. With this form of tuyeres the area at the large or discharge end was 84 square in., each giving a velocity of 2,500 ft. per minute. With this arrangement but little difficulty was experienced with slag forming at the mouth of the tuyeres, and should it show a tendency to collect, this difficulty can be overcome by changing the current from the top set to the bottom and *vice versâ* as required. The arrangement shown, therefore, appears to be an advantage over cupolas fitted with only a single row of tuyeres. The cupola in question is capable of melting 10 tons of iron per hour, and the volume of air supplied at a pressure of 28 in. of water equals 360,000 cubic ft. per hour, or 36,000 cubic ft. per ton of iron, and the coke consumption is 1½ cwts. of coke per ton, excluding the bed, which amounts to about 6½ cwts. The quantity and pressure of blast necessary for any given cupola depends upon so many varying and disturbing elements that experience and judgment must be mainly relied upon to estimate it. The method of charging the cupola, which after many experiments has been found most satisfactory, is 10 cwts. of iron, followed immediately by ¾ cwt. of coke.

Since 1½ cwts. of coke is burnt per ton of iron melted, the heat efficiency of the cupola may be calculated as follows:—The amount of coke required to melt 1 lb. iron = .0705 lb. Assuming the calorific value of the coke to be 12,000 B.T.U. per lb. the efficiency of the cupola =

$$\frac{414 \times 100}{12{,}000 \times .0705} = \frac{41{,}400}{846} = 49 \text{ per cent.}$$

At first the raw materials were lifted direct on to the cupola stage by means of an electric hoist. This electric hoist gave a good deal of trouble, partly with the electric fittings, the controllers, brake, etc., and partly the gearing. Owing to the dust and dirt the motor had to be cleaned several times a week, and after nine months' working the worm was completely worn out, and had to be replaced. Further trouble was caused by the fact that it was possible through carelessness or lack of knowledge to pull the switch right over and reverse the motor when at full speed; the result was that owing to the hoist being used by many different labourers, some of whom were unfamiliar with the working of it, the motor got very much punished, and there were continual complaints of the hoist breaking down. An important defect in this hoist was that the position of the cage at the top of the lift varied with the load. If it was set to stop level with the stage, with, say, half a ton, then when it had over this weight it stopped with the cage below the level of the stage, and if it had less weight than half a ton it stopped above the stage, the distance varying with the load. The power required by the hoist when lifting 1 ton was 12.45 e.h.p., and descending light 5.2 e.h.p., giving an efficiency for the double journey of 23.8 per cent. The speed of hoisting was 60 ft. per minute. When ascending light the power required was 3.4 e.h.p.

It was finally decided to do away with this hoist, and the raw material is now brought to the cupola by means of the direct-acting air hoist and overhead tramway, indicated on the plan Fig. 2, and shown in Fig. 9. This air hoist appears very satisfactory, being simple and reliable, and requiring practically no attention. With this hoist, which takes up about 30 cwts. of material per journey, two men are easily able to deal with the quantity of iron, coke, etc., required for the cupolas. The hoist makes about an average of 145 ascents per week. The power absorbed by the hoist when ascending is about 13.8 h.p., when descending no power is, of course, needed. The efficiency of this hoist when ascending with a total load of 36 cwts., including iron bogie and men, is 22.6 per cent., being, therefore, 1.2 per cent. less efficient than the electrical hoist. The air pressure is about 100 lbs. per square inch.

It must also be noted that whilst the power absorbed by the electrical hoist decreased with lighter loads, being 12.45 e.h.p. when loaded with 1 ton, and 3.4 e.h.p. when light; with the air hoist the same quantity of air is used, whatever the load may be, and, therefore, the hoist is not efficient with light loads.

Originally there were two core-drying stoves of the following capacities (see plan, Fig. 2):—Small one (B), 1,634 cubic feet; large one (C), 2,674 cubic feet; total capacity of two stoves, 4,308 cubic feet, or, 160 cubic yards. These were first heated by means of coke furnaces fired at the back of the stoves. The consumption of gas coke for the two

stoves in full work was at the rate of 17 cwts. per 24 hours, the price of fuel being 9s. 6d. per ton. The fires required attention every two hours. With this system the cost per week of heating the stoves was as follows :—7 days of 24 hours = 168 hours; attendance, 5 minutes per hour = 14 hours; 14 hours at 5d. per hour = 5s. 10d.; fuel, 17 cwts. per 24 hours = 6 tons per week at 9s. 6d. = £2 17s.; total cost per week = £3 2s. 10d. Therefore, cost per cubic yard per week = 4.71d.

The question of gas-fired core stoves was then considered, and it was decided to allow stoves B and C to still work with the coke furnaces, and to build a new stove A as an experiment, to be heated by gas. The cubical contents of the new stove were 2,617 cubic feet = 97 cubic yards, and it was found that this stove consumed in 24 hours, 7 cwts. of coke to generate sufficient gas, and required no night attendance, the producer being filled at 5 p.m. and again at 6 a.m. next morning, and clinkered every 48 hours. The total attendance to be charged against the stove would, therefore, be about 30 minutes in 24 hours, and the cost of heating the stove per week, as follows: — Attendance, 30 minutes per day for 7 days = 3½ hours at 5d. = 1s. 4½d.; fuel, 7 cwts. per 24 hours = 2½ tons per week at 9s. 6d. = £1 3s. 9d.; total = £1 5s. 1½d. Therefore, the total cost per cubic yard per week = 3.1d. Afterwards, a further gas producer was installed in connection with stoves B and C, which two stoves were at the same time enlarged, the total capacity of the three stoves being as follows :—A, 2,617 cubic feet; B, 2,493 cubic feet; C, 3,611 cubic feet; total, 8,721 cubic feet = 323 cubic yards. The two producers heating the three stoves consumed 16½ cwts. of coke per 24 hours = 115½ cwts. per week; the attendance amounted to 2½ hours per day = 17½ hours per week; so that the total cost per week of working the whole of the stoves on the system of gas firing is as follows :—Attendance, 17½ hours at 5d. =7s. 4d.; fuel, 5 $\frac{5}{6}$ tons at 9s. 6d. = £2 15s. 1d.; total. £3 2s. 5d. Therefore, the cost per cubic yard per week = 2.32d.

The reason for the marked difference in cost in heating the experimental stove as against the present cost of the three stoves is to be found in the fact that the producer used to heat the stove was too large for its work, and was therefore only working at part duty, whereas now it it worked to its full capacity. With the coke-fired stoves and open fires there was a tendency to burn the cores; this does not, however, appear to be the case with gas fires. The cores are now found to be more uniformly dried, and the heat better distributed throughout the stoves.

When building stove A a new type of asbestos lift door was fitted; this appears to work well and is found to be tighter and more lasting than the lath and roller doors originally fitted on stoves B and C; these latter doors, which are somewhat on the Venetian blind principle, leaked considerably, and suffered badly from corrosion.

The following figures of a test made

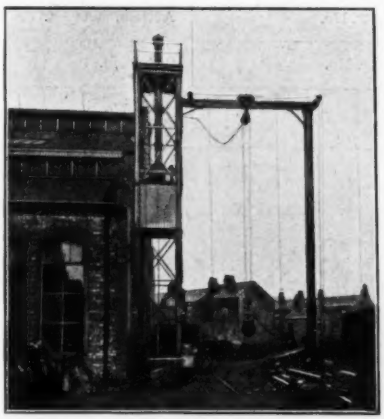


FIG. 9.—HOIST AND TUPPING ARRANGEMENT.

of the temperatures in connection with two gas-fired cores may be of interest. The stoves were filled with green cores and closed down at 6.30 p.m., and the readings were taken at the times stated :—

STOVE A.

	9-15 p.m.	10-0 p.m.	10-15 p.m.
End of stove where hot gases are admitted...	470°F	520°F	
End of stove where hot gases pass away to chimney	427°F		
Exit flue near chimney	280°F		296°F
Centre of length near top of stove		550°F	

STOVE C.

	9-30 p.m.	10-0 p.m.	10-15 p.m.
Centre of length near top of stove	440°F	460°F	520°F
End where hot gases leave the stove ...	390°F	410°F	412°F

The temperature of gases in the chimney pedestal was 240 degrees Fahr. at 9.30 p.m.

In connection with stove A the tem-

perature at the entrance and exit of the gases was obtained by passing thermometers through the asbestos screen. The thermometers were in the first instance inserted with the bulbs 3 ft. 6 in. from the screen, and they were moved several times during the observations so that the bulbs were finally 4 ft. 9 in. from this screen. No change in temperature could be observed when the position of the thermometer was thus altered.

The ordinary observation holes were also used for the insertion of the thermometers, which holes are about 4 ft. 6 in. from the bottom of the stove and 2 ft. from either end. The thermometers were inserted in the stove A at 8.45, and from 9 o'clock to 9.30 the temperature was almost constant, and is given by the record for 9.15 p.m. From 9.45 to 10.20 the temperatures showed a steady increase; especially was this the case for the observations made near the top of the stove.

The consideration of these figures has suggested that a method, which is at least novel to the writer, might be deduced from them of determining when the contents of a stove were quite dry. The difference of temperature between the gases when entering the stove and when leaving is due to the heat given up to the cores plus a constant amount for radiation, etc. When, therefore, the cores are quite dry the difference between the temperature of the gases on entrance and exit would decrease and finally become constant. Two thermometers would, therefore, enable the time to be easily determined when the cores were all dry.

In order to relieve the main travellers, 1-ton jib cranes have been fixed along the main bay in the foundry. These cranes are actuated by compressed air at a pressure of about 100 lbs.; they have up to now proved satisfactory, and require much less cleaning than electrical jibs would have done in the same position. A difficulty with these air-driven cranes is that when withdrawing the patterns from the sand they are apt to be jerked instead of steadily lifted, due to the fact that at the moment when the vacuum under the pattern is destroyed the load is much reduced, and consequently the pattern is jerked upwards.

Patt. No.		Article.					Max.				Prog. No.
Drg. No.		Order No.					Min.				
Date Ord.	Quantity.	Date Pat.in	No. d/d.	Date.	Bal.	No. d.d.	Date.	Bal.	No. d/d.	Date.	Bal.

Actual size of card, 5 in. by 3 in.

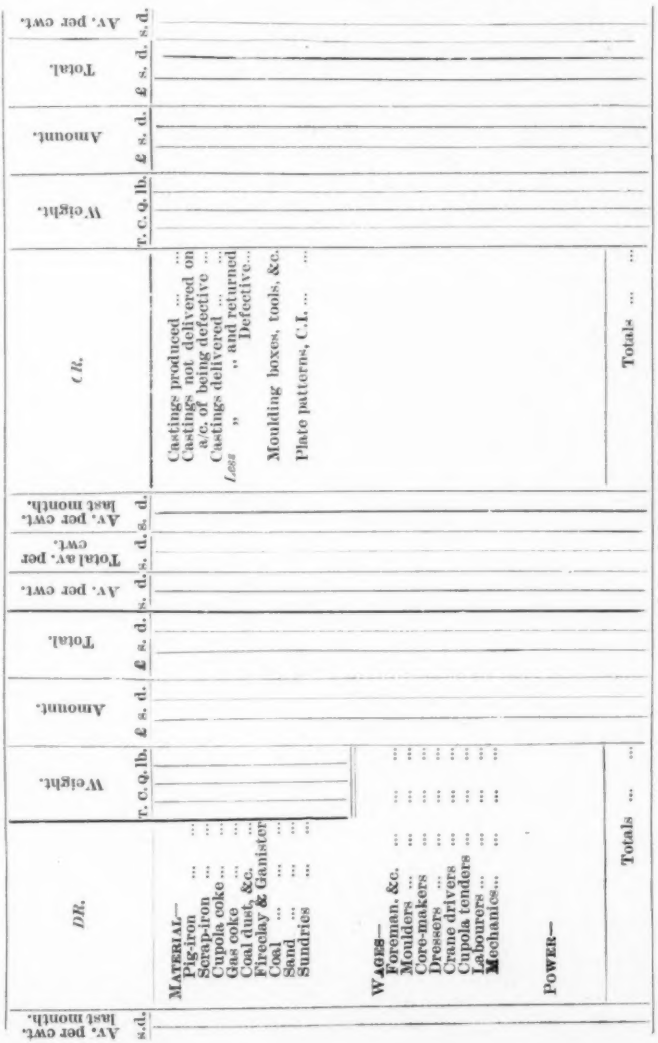
The largest piece put into the rattlers is a casting 4 ft. 3 in. × 3 ft. 4 in. × 2 ft., weighing 31 cwts. The total weight in the large rattler averages 5 tons, including scrap, and the time of rattling is 2½ hours.

The average weight of castings off three moulding machines is 8½ tons per week, the largest single casting being 2½ cwts. The average cost of moulding is 8d., core-making 2d., and dressing 4d. per cwt.

f. Foundry Accounts and Cost of Production.—It is now customary in all well organised works to have departmental costs got out to ascertain what portion of the factory or what class of work is productive or unproductive of profit. With some departments it is difficult to allocate fairly the amount of "standing

charges," as there is a considerable amount of overlapping between one department and another, but with the foundry the task need not be complicated, especially if it be in an entirely separate building. To facilitate this the accounts might be kept as though it were an independent business. In the first place a correct return should be made of all capital expenditure on the foundry, and so far as practicable separate books used apart from other departments, and all materials requisitioned by and charged direct to that department.

All orders for castings from the foundry are issued from the works stores department upon order cards which are sent to the pattern stores, and the man in charge goes through the order with the purpose of seeing that all necessary patterns are ready for the foundry.



When the patterns reach the foundry a small check giving the pattern number is hung on a board in the foundry office, and this check hangs there so long as the pattern remains in the foundry, and is returned to the pattern store with the pattern. The order card reaches the

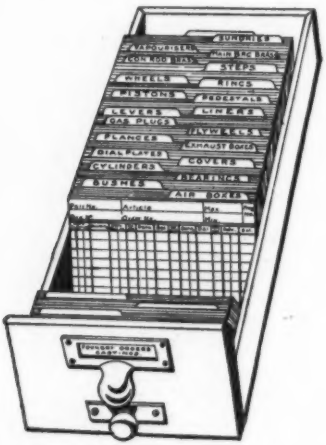


FIG. 10.—CARD FILING DRAWER.

foundry with the pattern, and is filed away in a drawer for the convenience of the foundry foreman, who can readily see what orders to give out for any particular details. A copy of the card is appended, and an illustration of the filing drawer is shown in Fig. 10.

A return should be made each month showing the amount of castings turned out and the cost of production in detail; all the various materials used and the different classes of labour being given, and by means of percentages a comparison made with the previous month, or for any other past period. All materials should be weighed before being put into the cupola, and these amounts can be further checked periodically by comparison with the stock books.

Subjoined is a copy of a cost sheet which answers this purpose, and has been found satisfactory. The credit side shows the castings produced and invoiced out at prices which are based upon quotations obtained from outside foundries for similar castings.

In the foundry under consideration the work is largely done under the piecework system, the bonus being paid twice a month. Moulders' prices are fixed for each article, and all castings defective due to moulding are debited back against the man. Core-makers are paid for each core or part of a core (when the complete core consists of more than one part). Dressers are paid on the tonnage dressed, the castings being grouped into four classes. Dressers' labourers participate in the bonus. General foundry labourers (other than in fettling shop) are not on piecework, and do not participate in any bonuses.

If the whole system of foundry account keeping be carefully started, it does not entail much cost or trouble to maintain, and the information obtained will be found most valuable, as it enables the management to watch the progress of the foundry as it goes along.

Schedule of Foundry Plant.

IRON FOUNDRY.

CUPOLAS (two). Diameter of shell 5 ft. Height, 39 ft.

TRAVELLING CRANES (electric).

Specified Speeds with Full Loads in Feet per Minute.

No.	Position.	Load.	Longitudinal travel.	Cross travel.	Lifting.	Span.	Remarks.
		Tons.				Ft. in.	
1	Main bay	25	200	80	9	50 3	2 barrels.
2	Main bay	5	200	100	16	50 3	1 barrel.
3	Cupola side ...	2	100	hand	20	23 2	
4	Core stove side ...	5	300	100	20	23 2	
5	Fettling shop ...	20	200	80	9	50 3	2 barrels.

JIB CRANES :—

Five one-ton pneumatic jib cranes.
Radius of arm 20 ft.
Diameter of lifting cylinder 6 in.
Stroke 7 ft.
Air pressure 100 lbs. per square inch.

CUPOLA HOIST :—

One direct-acting air hoist capable of lifting two tons. Lifting cylinder diameter = 10 in. Stroke = 19 ft. Speed of lift at full load = 39 ft. per minute.

LOCO. JIB CRANE :—
One four-ton crane driven by a 13 b.h.p. petrol engine.

MOTORS :—

Position.	Power.	Duty.
Blower room.	One 40 b.h.p.	Cupola Blower.
In foundry.	One 40 b.h.p.	Sand Mill Rattlers, etc.

BLOWER AND FAN :—
One Root's Acme blower. Capacity 6,000 cubic feet of air per minute at 28 in. pressure.
Speed 320 r.p.m.
One fan for blowing small Piftin furnace.

SAND APPLIANCES :—
One sand grinding mill with 6 ft. dia. pan.
One sand sifter.
One moulding sand mixing machine.
One tripod type pneumatic sand shaker.
One pneumatic self-emptying riddle.

PUMP :—
One single-acting ram pump. Capacity, 650 gallons per hour to a height of 20 ft.

WEIGHING MACHINES :—
One-ton weighing machine made specially to suit floor of cupola stage. The castings are delivered by the foundry on the works weighing machine.

RATTLERS :—
One 24-in. internal diameter × 56 in. long.
One 4 ft. diameter × 6 ft. long.
One 4 ft. 3 in. diameter × 6 ft. long.

MOULDING MACHINES :—
One taking a box 30 in. × 20 in.
One ,, 24 in. × 18 in.
One ,, 20 in. × 13 in.
One ,, 24 in. × 18 in.
Pattern plate apparatus.
Six core oven carriages.
One emery grinder.
One grindstone trough.
One ash washer.
One pickling tank.
Two portable Piftin furnaces.
One sand blast machine.
Two Rochester time recorders.
Shafting pulleys, belts, compressed air, water, electric light and power service, ladles, benches and bins, core shelves and stands, pattern rack and tupping arrangement.

BRASS FOUNDRY.
One 2-h.p. electric motor driving small rattler.
One 10-cwt. platform weighing machine.
One 1-cwt. counter weighing machine.
One rattler, 1 ft. 8 in. diameter × 3 ft. 6 in. long.

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GALVANISED SHEET STEEL PIPING: ITS USE FOR REMOVING FUMES AND DUST AND FOR HEATING FOUNDRIES.

OF late years increasing attention has been given to the health of the working

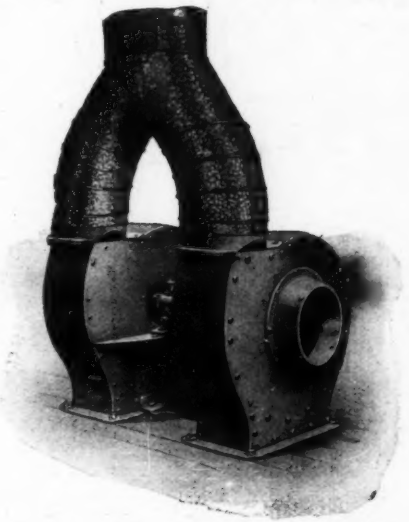

FIG. 1.—"STURTEVANT' BREECHES PIECE WITH SPRINGS.

classes, a matter in which perhaps our manufacturers have been rather behind the times. In the cases of certain industries, such as brass casting, the question of securing immunity from the effects of noxious fumes has recently formed the subject of a set of special rules, which will no doubt shortly be put in force, either in full or in a modified form. In the case of the second *desideratum*, namely, that of securing greater comfort for workpeople by the use of apparatus for heating workshops, lavatories, etc., many of the better managed shops are now so equipped. The construction of such apparatus demands the use of special machinery, and cannot be left to the ordinary tinsmith with

limited facilities and scanty experience. The success of an installation for dust exhausting, or heating and ventilating, may easily be nullified by a poorly designed or badly constructed system of piping.

The necessity for carefully designing such piping cannot be over-estimated. A pipe system in which the areas are not properly proportioned, or where the direction of the air current is changed too suddenly by the use of elbows or bends of too small a radius, entails the waste of a large amount of power and necessitates the fan running at a far higher speed than would

FIG. 5.—"STURTEVANT" PLANT FOR EXHAUSTING FUMES FROM CRUCIBLES IN A BRASS FOUNDRY.

otherwise be necessary. For instance, a fan taking 10 h.p. at its normal speed, might very easily require 16 h.p. when run at the higher speed necessary to counteract the bad effects of a defective pipe system, with the result that many times the original cost of the plant might be wasted during a period equal to the life of the plant.

Piping required merely for the passage of air may be constructed of material as light as is consistent with stability, whereas piping for the conveyance of sawdust, chips, shavings, and so forth, must be heavier in order to withstand the abrasive action of the material passing through.

The correct formation of bends in both round and rectangular piping is a most important feature, as it is absolutely necessary for the efficient working of the plant that any change in the direction of the air or material should be made as gradual and as smooth as possible. Square elbows are in all cases to be avoided, as their use materially reduces the efficiency of the system. In order to secure a bend of sufficiently large radius it is necessary that it be made in sections with seamed or riveted joints. Two standard types have been adopted by the Sturtevant Engineering Company, Limited, the radius of the inner edge of the bend being equal to either one or two pipe diameters. So-called springs are bends of less than 90 degrees curvature, and can be made to suit any angle.

FIG. 2.—"STURTEVANT" RECTANGULAR TEE PIECE WITH REGISTERS.

Fig. 1 shows a form of joint construction called a breeches piece, and used when two branches diverge equally on either side of a main.

Fig. 2 illustrates a speciality in rectangular piping work. It shows a rectangular tee-piece fitted with registers.

FIG. 3.—"STURTEVANT" DUST GATE.

Such an appliance is largely employed in ventilating systems, the registers being provided with adjustable louvres, which serve as a ready means for controlling the passage of the air.

FIG. 4.—"STURTEVANT" DUST SEPARATOR; SECTIONAL VIEW.

A form of damper or dust gate largely employed in installations for conveying material such as sawdust, emery dust, and the like, is shown in Fig. 3. These gates

can be fixed in any position by simply cutting a slot in the pipe for the slide to pass through, the body of the gate being riveted or bolted on the outside of the pipe.

The "Sturtevant" improved dust separator, as shown in section in Fig. 4, is an appliance for separating dust, refuse, etc., from the air coming from a fan connected to machines. It is made of strong galvanised sheet steel. It has an opening at the top for the escape of air, and an aperture at the bottom of the cone for the escape of the dust. The air laden

FIG. 6.—INTERIOR OF A MODERN FOUNDRY, EQUIPPED WITH "STURTEVANT" OVERHEAD RECTANGULAR PIPES.

with dust and refuse from the machines enters the upper part of the separator. The force of the blast drives this material against the sides of the casing, giving it a spiral motion, which causes it to descend to the lower end and finally to fall through the opening at the bottom into a storage chamber or stokehole. The air from the fan, thus freed from dust, escapes through the opening at the top of the separator. In cases where the dust or refuse is used as fuel in the boilers, the separator can be usefully located in such a position that the material will fall into a convenient part of the stoke-hole for easy shovelling into the furnaces.

Fig. 5 gives an interior view of a brass foundry equipped with a "Sturtevant" plant for exhausting fumes from the crucibles. In the foreground is depicted apparatus for the removal of dust from a tumbling barrel and a sand blast machine.

Fig. 6 gives a view of a foundry fitted with overhead rectangular pipes, the fan and heater being located in a room adjoining the far end of the building.

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FOUNDRY CUPULA AND IRON MIXTURES.

Discussing the paper by Mr. W. J. Keep, published in our December issue, Mr. G. R. Brandon writes:—Having had many years' experience in the manufacture of the Whiting cupolas and being in constant touch with operators of these cupolas, Mr. Keep's paper has been of especial interest to me. I desire to comment on several points he raises:—

Cupola linings commonly consist of backing brick next to the shell, blocks 4½ in. or 6 in. thick, forming the inside lining, coming in contact with the heat and having to withstand the abrasive action of the stock in descent from charging door. The blocks are usually of volume equal to about 3 "square" bricks, and prices are practically the same, the volume being considered. In setting lining, the work may be accomplished more quickly and cheaply with blocks; and, on account of the fewer joints exposed to the action of the heat, inner linings last longer when composed of blocks than of the same quality of "square" and arch brick.

The usual instructions to operators of cupolas are to maintain inside walls of linings vertical and cylindrical in section from bottom plate to charging door, and to pick out slag attached to brick before each heat, and apply daubing mixture. The simplicity of this procedure is its greatest recommendation; but, as safety from "hang-ups" is assured if cupola is operated properly in other respects, the very doubtful benefit derived from reduced bosh and enlarged melting zone may be disregarded.

Tuyeres may be located so that any suitable quantity of molten metal may be accumulated in the cupola before tapping. In the converter processes for steel castings iron is first melted in cupolas, and it is usual to collect the entire amount for a charge in the cupola before tapping out, the tuyeres being set to permit this accumulation.

The lower the tuyeres, the less the amount of fuel on the bed, and the greater economy. It must be remembered, however, that fuel in bed serves the purpose of heating up the cupola, and sufficient must be charged to accomplish this result, whatever the height of tuyeres.

The standard tuyeres of the Whiting cupola are flaring, the opening at the inside of lining being wide horizontally, and comparatively narrow vertically. The adjacent tuyeres in the lower row almost meet, practically forming a complete annular inlet.

One frequent cause of "run-outs" through bottom doors is the use of overhanging linings. The sand of the bottom not being tucked properly under the projecting lining at all points, the molten metal cuts through in a weak spot. In this emergency a tap hole should be opened, all molten metal drained out and a stream of water directed on the hole through the bottom to "freeze it." Plugging the hole with clay will allow the completion of the heat.

For cupolas with 84-in. shell, and larger, a mechanical charging machine can be used and the labour of charging greatly reduced. Records show that two men with this machine can charge a cupola melting 18 to 20 tons per hour, whereas, without the machine, five or six men would have been required.

I have never known of records of actual operation, showing as high a ratio of iron to fuel as 18 to 1. This would be practically impossible with our wheels. Mixtures for car wheels are low in silicon, and, consequently, the molten metal lacks fluidity and must be very hot when tapped and poured quickly. Steel is now generally used in car wheel mixtures, and this requires more coke. Pigs and large scrap are generally considered to require more fuel than broken pigs and

smaller scrap. We have a record covering eleven months' operations in which over 13,000 tons were melted for car castings, the ratio of iron to fuel being 10.31 to 1. These results have always been considered most excellent.

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LIST OF NEW INVENTIONS.

Specially compiled for THE FOUNDRY TRADE JOURNAL by MR. GEORGE BARKER, Fellow of the Chartered Institute of Patent Agents, Consulting Engineer and Chartered Patent Agent, 77, Colmore Row, BIRMINGHAM.

27,922. H. R. ANGEL. Improvements in the treatment and reduction of complex sulphide and other ores.

28,154. J. SOUTHALL. Improvements in moulding manhole covers and frames.

28,637. J. Y. JOHNSON. Improvements in the preparation of efflorescent ores for smelting.

31,908. A. R. WINPENNY. Improvements in rotary pumps, blowers, exhausters, and the like.

419. W. P. THOMPSON. Improved process for making dense and uniform castings from copper and copper alloys.

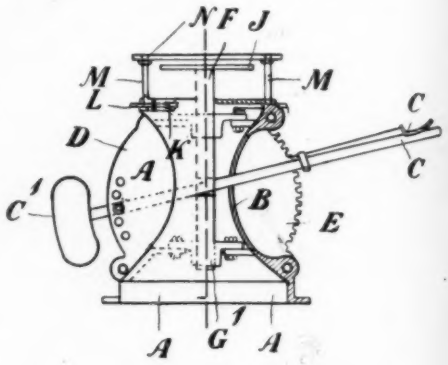
458. E. BECKWITH and R. C. HARRISON. Improvements in sand buckets, pails, and the like.

490. RUDGE-WHITWORTH, LIMITED, and H. L. HEATHCOTE. Improvement in the treatment of iron or steel for the prevention of oxidation or rust.

5966. A.D. 1907. A. GREEN, Chesterfield. Improvements in sand moulding machines.

The object of this invention is to construct a moulding machine that shall be much simpler in its action, lighter in its construction, and adapted for use with several sizes of boxes.

The figure shows a partial section of one of these machines looked at from the side. The body or standard *a*, is made of wrought or cast metal in the form of a double-ended cone, and is slotted at the waist by a longitudinal slot *b*, through which is passed a lever *c*, one end of which is carried on a suitable pillar or bracket *d* outside the cone, and the other end of which works in a vertical or radial slide *e* provided with notches, and a pin by which the lever may be held in any desired position. A counterweight *c* may be used to balance the weight of the ram *f* and its head. The ram *f* works in a guide *g*, g^1 down the centre of the stand, and other guides are used to prevent a sideward motion. The ram may be reciprocated by the lever as shown. The various sizes of pattern



plates employed in the machine are fixed on the boss or head *j*. By means of nuts and bolts, and radial slotted arms *l* working in brackets *k* and studs *m*, the stripping plate *n* can be removed, and a fresh one put in place or adjusted as required, and thus several sizes of boxes can be used on one machine.

These machines may be used in pairs when required, and twin machines may also be permitted.

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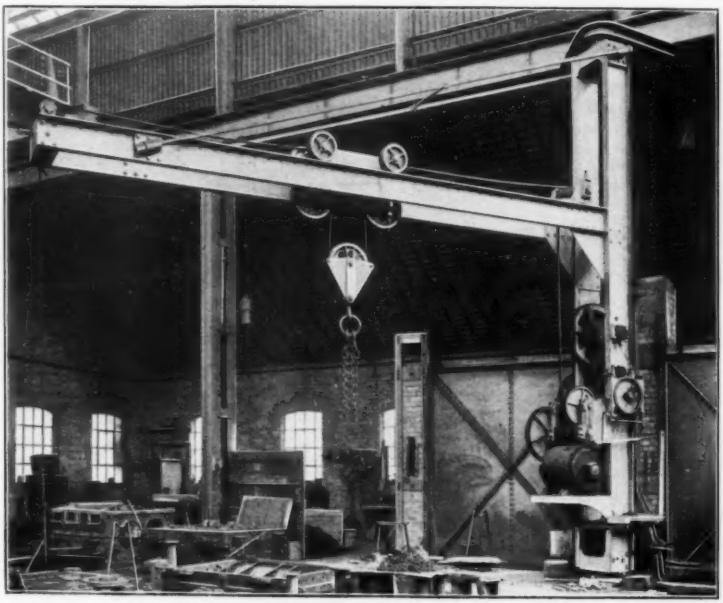
HICKMAN, BATCHELOR & COMPANY, LIMITED, 713, Salisbury House, London Wall, E.C., have been appointed sole agents for the United Kingdom by the Klosters Aktiebolag, Langshyttan Sweden, and H. D. Wilke Nachfolger, of Letmathe i/W., Germany.

A STATEMENT has been issued of the affairs of Daniel Smith, carrying on business as Daniel Smith & Company, Raglan Street, Wolverhampton, engineer and ironfounder, who has been adjudged bankrupt. The summary shows gross liabilities £8,153 2s. 10d., of which there is expected to rank for dividend £6,526 15s. The assets are estimated by debtor to produce £5,900 7s. 5d. The deficiency is put down as £626 8s. 1d. Debtor attributes his failure to insufficient capital, pressure from creditors, and interference in the management of the business.

A FOUNDRY JIB CRANE.

THE annexed photograph shows a 5-ton electric jib crane, for a rake of 20 ft. and 14 ft. lift, driven by a 12-b.h.p. motor, running at 400 revolutions per minute, on a 240-volts. circuit, direct-current. The photograph is of a type of crane of which the makers—the Leeds Engineering and Hydraulic Company, Limited, of Rodley—have supplied a large number, of varying powers, to many of the leading foundries in this country, and also for a Government foundry abroad.



ELECTRIC FOUNDRY JIB CRANE.

The cranes have power for lifting and racking, this latter being done by means of plate chain and sprocket wheels; whilst the slewing is done by hand, which is easily effected, as the cranes are mounted on a ball-bearing footstep; the cranes are fitted with shunt-wound motors, with suitable starters, fitted with no-voltage release, and in circuit with an automatic cut-out or trip switch to prevent accident from overwinding; both motor and starter are totally enclosed for foundry work. The cranes are operated from a platform carried on the mast by means of clutch gear operated by hand wheel and spur gearing. The crane driver has always a full view of the load.

BRITISH FOUNDRYMEN'S ASSOCIATION.

Birmingham Branch.

A MEETING of the Birmingham Branch of the British Foundrymen's Association was held on Saturday, January 25, at the Technical School, Birmingham, when MR. A. H. HIORNS lectured before a large audience on "The Effect of Carbon on Iron." The lecture was illustrated with lime-light views and a large number of diagrams.

The lecturer pointed out that it was practically impossible to obtain a sample of iron absolutely free from carbon, and there was no known means of removing carbon from solid iron without destroying the iron. The speaker dealt at considerable length with the modifications effected upon iron and steel by various carbon treatments, and in regard to steel upon the precise colours evolved. There was no real line of difference between steel in cast iron, except the arbitrary one of percentage of carbon. In steel, the carbon seldom exceeded 1.5 per cent., while in cast iron it averaged 3 per cent. Pure cast-iron was simply a more highly carburetted form of steel. Iron

was often grey because of the presence of silicon, which did not induce the carbon to pass into the combined form, and allowed it to separate out as graphite, which made the metal much softer. Mottled cast iron was an intimate mixture of grey and white in which either the graphite or the combined carbon might predominate, and the metal would be roughly intermediate in properties between the softness of the grey and the hardness of the white iron. By means of a number of interesting diagrams the speaker showed that the high tensile strength of malleable castings proved that the smallness of the carbon particles was the chief cause of the increased strength, and on the other hand that larger particles of graphite prevented contact between the particles, and by thus destroying the continuity, weakened the iron. Carbide of iron, when present in moderate quantity, say, 1 per cent., increased the tensile strength.

Under the head of diamond carbon, the speaker pointed out the close connection between graphite in the diamond, which was simply another form of carbon. The most successful attempts to form artificial diamonds had been made with cast iron by making use of the pressure resulting from the increase of volume undergone by a mass of molten iron as it passed from the liquid to the solid state. The bright particles produced by plunging iron saturated with carbon, at a high temperature, into a bath of cold water were very minute, but appeared to be real diamonds. The diamond was one of the hardest substances known, and if diamond carbon existed in hardened steel and white cast-iron, the great hardness of those metals might be attributed to its presence. The question for solution was: what were the exact conditions for getting diamond instead of graphite carbon from cast-iron?

The speaker showed the effect of chill upon cast iron, considering that the best effects as regarded depth of chill were produced with 1 per cent. or less of silicon, with less than ½ per cent. of phosphorus, and about 1½ per cent. manganese. High silicon conduced to rapid chilling, while aluminium reduced the depth of chill. With regard to the different methods of manufacture, basic open-hearth steel was softer than acid Bessemer, and higher carbon would be required in the former to give the same degree of hardness as the latter. The speaker showed the effect of temperature at various degrees, especially for hardening.

Mr. R. Buchanan, the Chairman, in opening the discussion, said it was refreshing to hear the carbon question discussed in its various bearings. For everyone engaged in foundry work the position, conduct, and condition of carbon was a matter of the greatest importance. If they could obtain clear views as to what was happening in the casting in regard to carbon they would go a long way towards regulating and securing complete control of their products. To know the influence of carbon and the influence of other elements on the carbon was the most essential thing to satisfactory production. With regard to the diamond question, Sir William Crooks had pointed out that diamonds were always found in a natural state in volcanic matter in South Africa, being extracted from the mud of volcanic matter, and it was understood that they were produced from carbon gases at temperatures of which in these times they knew absolutely nothing, and which were not possible even with electric furnaces. So far they had failed to produce the two conditions of intense heat and pressure necessary to produce diamonds.

A hearty vote of thanks was accorded the lecturer, on the proposition of Mr. Evans, seconded by Mr. R. Mason.

Mr. Buchanan remarked that they were very deeply indebted to Mr. Hiorns for practically returning to his own workshop in order to instruct the foundrymen. That showed once more his keen interest in their Association.

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The Burmah Engineering and Trading Company, Limited.—Capital £25,000, to carry on the business hitherto carried on in Burmah by A. R. Brown, M'Farlane & Company, Limited. Registered office: 34, West George Street, Glasgow.

Messrs. Michael Pal & Company, engineers, of Parliament Mansions, Victoria Street, London. S.W., have been appointed sole agents for the United Kingdom and Colonies for Messrs. Louis Schwarz & Company Aktiengesellschaft, Dortmund, who are specialists in low pressure steam turbines, condensing plant, cooling towers, heat accumulators, and have special designs for cleaning efficiently blast furnace gases, to be utilised for driving big gas engines.

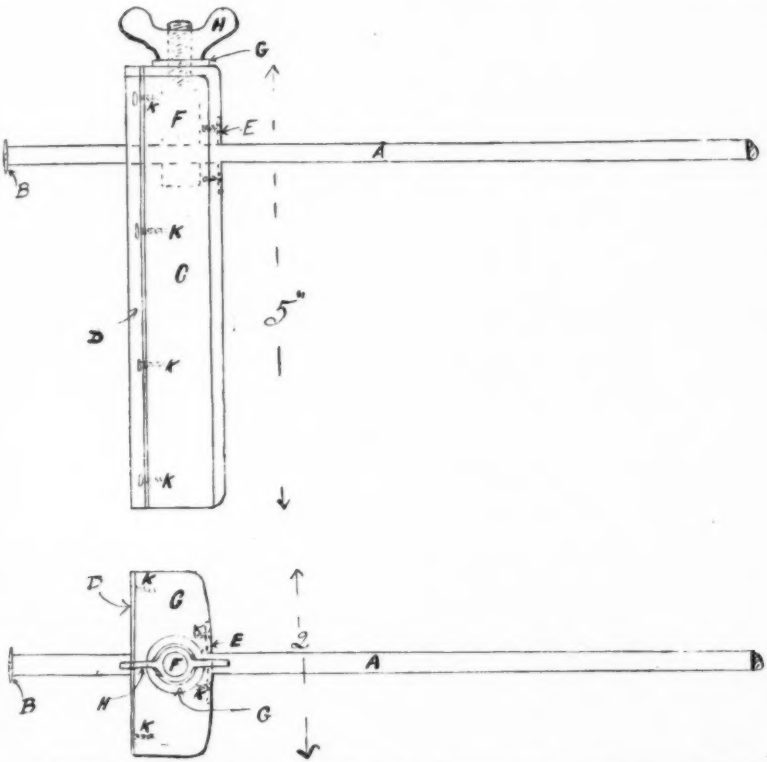
A SIMPLE, BUT EFFICIENT PATTERN-MAKERS' HOME-MADE GAUGE.

THE annexed illustration shows a home-made gauge for pattern-makers. It is best described by the following references to the lettering on the sketch:—

A is a piece of steel wire $\frac{13}{16}$ diameter by 12 in. long.

K's are screws to fasten plate and washer on to C (back and front).

The sketch is self-explanatory, but a few remarks relating to it will not be out of place. When thumb nut H is screwed up, it causes the steel wire A to impinge itself on to the plate D and washer G, which sets the wire A quite firmly at right angles to the face of the gauge to whatever distance is required. When thumb nut H is unscrewed the steel wire A is released, and it may be moved along to set gauge.



A PATTERN-MAKER'S HOME-MADE GAUGE; DESIGNED BY T. ALDCROFT, CROSBY.

B is a round cutter $\frac{3}{8}$ in. diameter, on the end of A.

C is the wood part of the gauge, made of good dry beech or walnut.

D is a piece of brass or steel plate $\frac{1}{16}$ in. thick, screwed on the face of C.

E is a brass washer let into the back of gauge.

F is the brass tightening sleeve.

G is a brass washer.

H is a brass thumb nut.

The advantages of the gauge are many: the cutter is easily sharpened with a slip, it cuts a perfectly clean line either with the grain or across the grain, it cuts a much finer and cleaner line than the ordinary pin-wire gauge, and it has a very long reach, at the same time being perfectly rigid. The length of face is a great advantage.

TRADE TALK.

MESSRS. J. H. POWNALL and W. TAYLOR, engineers, Macclesfield, have dissolved partnership.

DRYSDALE & COMPANY, LIMITED, engineers, Glasgow, have removed to the Bon Accord Works, Yoker.

MESSRS. F. J. ROBINSON and W. J. S. JONES, engineers, Newcastle-upon-Tyne, have dissolved partnership.

MESSRS. R. G. HISLOP, engineers, 13, St. James' Place, Paisley, have removed to Underwood House, Paisley.

A MOVEMENT is on foot to organise an employers' association for the engineering trade in Coventry and district.

MR. PETER BROTHERHOOD, engineer, of Belvedere Road, London, S.E., has removed to 53, Parliament Street, S.W.

THE VICTORIA TUBE WORKS, Coatbridge, of James Allan & Sons, have been acquired by Stewarts & Lloyds, Limited.

NEGOTIATIONS are in progress for the acquisition by a Scottish company of the site of the Oldside Iron Works at Maryport.

A DISSOLUTION of partnership is notified in connection with Messrs. J. A. Mowle & T. B. Meacock, engineers, etc., Chester.

MESSRS. W. NEWTON, H. BEAN, and J. S. MITCHELL, engineers, Bradford, have dissolved partnership so far as regards Mr. W. Newton.

MESSRS. RUBERY, OWEN & COMPANY, Victoria Iron Works, Darlaston, have appointed Mr. W. C. Proctor as their London representative.

MESSRS. PATON & COMPANY, Pontypool, have taken a lease of the Pill Point Shipbuilding Yard, Milford Haven, for ship-breaking purposes.

MESSRS. H. E. SAMPSON, F. H. SAMPSON, and F. E. SAMPSON, mechanical engineers, etc., Bedminster, Bristol, have dissolved partnership.

MR. J. W. TAYLOR has opened an office at Lord's Chambers, 26, Corporation Street, Manchester, where he will carry on business as an engineer.

DAMAGE amounting to several thousand pounds was caused by a fire recently at the engineering works of Messrs. Crow, Harvey & Company, Glasgow.

THE FAIRFIELD SHIPBUILDING AND ENGINEERING COMPANY, LIMITED, has removed its registered office to 9, Victoria Street, Westminster, London, S.W.

J. HOPKINSON & COMPANY, LIMITED, Huddersfield, have opened a showroom and depôt at 14, Rue Faidherbe, Lille, which is in charge of Mr. M. Goubet.

N. HINGLEY & SONS, LIMITED, Netherton Iron Works, Dudley, have acquired the business of George Hartshorne & Company, Limited, Netherton, Dudley.

MESSRS. L. A. KNIGHT, W. H. GARBETT, J. J. H. LINES, and J. M. YATES, engineers, Stafford, notify a dissolution of partnership so far as regards Mr. J. M. Yates.

A FIRE broke out recently at the East Hecla Works of the Hadfield's Steel Foundry Company, Limited, Tinsley, Sheffield, doing damage to the extent of about £1,000.

MESSRS. SPERLING & WILLIAMS, 24, Fenchurch Street, London, E.C., have been appointed sole export agents for Grice's Gas Engine Company, Limited, of Birmingham and Carnoustie.

MR. J. SAMBIDGE, of the British Westinghouse Company, and Mr. E. W. Ward, of the Phœnix Dynamo Manufacturing Company, have started business at 17, Victoria Street, S.W., as engineers.

MESSRS. TETLEY & COMPANY, Salford, Manchester, have appointed Mr. H. C. Hodgson, 577, Mansion House Chambers, 20, Bucklersbury, London, E.C., as their sole selling agent for London and district.

A VERY destructive fire broke out recently at the engineering works of Messrs. F. J. Hill & Company, trading as Death & Ellwood, Joseph Street, Leicester. The premises were badly damaged.

THE SHEEPBRIDGE COAL AND IRON COMPANY, LIMITED, are extending their already large plant and erecting additional shops for the manufacture of cast-iron pipes on a much larger scale than at present.

THE enquiry into the draft regulations for the generation, transformation, distribution, and use of electrical energy, will be opened by Mr. J. Swinburne at the Council Chambers, Caxton Hall, Westminster, S.W., on March 3 next.

THE latest time recorder of the International Time Recording Company, 151, etc., City Road, London, E.C., is of the "Rochester" type, and automatically prints the regular time of arrival of employés in blue, and the "late-comers" in red.

Mr. S. T. Pemberton, Council Chambers, 109, Colmore Row, Birmingham, the Midland Counties agent for Electromotors, Limited, has also been appointed sole agent in his district for Messrs. Dorman & Smith, and Connolly Bros., Limited.

Sir William Lloyd Wise, consulting engineer, 46, Lincoln's Inn Fields, London, E.C., has retired, and the business is now being carried on under the style of Lloyd, Wise & Company, by Messrs. F. J. Brougham, W. Cross, F. W. Howorth, and A. Woosnam.

The Midland Manufacturing Company, Limited, Savile Street East, Sheffield, have put on the market their patent iron workers' leather gloves and gauntlets, which, besides being stitched as at present in use, are strengthened by the use of clasps or studs.

Mr. Edward Oakes, 46, Ashfield Road, Rusholme, Manchester, has been appointed agent for Lancashire, Yorkshire, and the North of England, for the Britannia Foundry Company, Coventry, who are makers of the "Coventry," patent moulding machine, band saws, sprue cutters, and other foundry requisites.

The partnership hitherto existing between Mr. W. Hodgson, senior, Mr. W. Hodgson, junior, Mr. C. Hodgson, Mr. A. Hodgson, and Mr. W. Inman, trading as Hodgson & Stead, weighing machine manufacturers, Windsor Street, Salford, has been dissolved by mutual consent, and the business converted into a private limited company.

The Vulcan Foundry, Limited, of Newton-le-Willows, have lately delivered to the Indian North-Western State Railways 50 locomotives of the "Consolidation" type, 2—8—0. The mountings of these engines include Wakefield's double-sight feed lubricator, automatic vacuum brake equipment for engine and tender, and injectors by Gresham & Craven.

Rumours have lately been circulated to the effect that the Lowca Engine Works, Whitehaven, of the Lowca Engineering Company, Limited, have been shut down, but we are officially informed that such is not the case. A new company has been formed to take over the assets of the old company, and arrangements are in progress for the development of the company's general business.

Mr. W. Griffiths, 25, Botanic Avenue, Belfast, has been appointed representative for Ireland for Messrs. Edward Bennis & Company, Limited, Little Hulton, Bolton. Mr. E. Harris, the company's agent for East Yorkshire, has removed to "Hill Crest," Horsforth, Leeds, while Mr. F. K. Woodroffe, their agent for Liverpool, North Wales, etc., has removed to "Melville," Hoole Road, Chester.

DEATHS.

Mr. J. F. Maclaren, ironfounder, of Port Eglinton, Glasgow, aged 40.

Mr. J. J. Tolley, ironmaster, of Crescent Road, Darlaston, in his 83rd year.

Mr. A. Haigh, managing director of Messrs. Allan Haigh & Company, brassfounders, Halifax, in his 68th year.

Mr. G. C. Ogle, head of the firm of Messrs. G. C. Ogle & Son, agricultural engineers, Perseverance Works, Ripley.

Mr. G. H. Knighton, of the firm of Simkiss & Knighton, California Engineering Works, Derby, at the age of 54 years.

Mr. J. Cass, ironfounder, of Bury. The deceased gentleman will probably be best remembered as the patentee of Cass's fire-bar.

Mr. D. M'Gee, director and shipyard manager of Messrs. John Brown & Company's large shipbuilding establishment at Clydebank, at 50 years of age.

Mr. J. Macfarlane Gray, late Chief Examiner of Engineers to the Board of Trade, and a member of the Institution of Mechanical Engineers, at 77 years of age.

Mr. L. Baxendale, head of the Manchester firm of Baxendale & Company ironfounders, at Westby, near St. Annes, at the age of 76 years. He had lived in retirement for some years at Westby, and left Manchester 15 years ago.

Major R. Dobbie, head of the firm of Dobbie, Forbes & Company, Larbert Foundry, Stirlingshire, aged 69. He was a well-known figure in the public life of the county, being a member of almost all the chief boards and councils

Mr. J. Welsh, manager of the engineering department of Messrs. A. & J. Inglis, shipbuilders and engineers, Glasgow, at his residence, 3, Princes Gardens, Dowanhill. Mr. Welsh, who was 40 years of age, served his apprenticeship with Messrs. Inglis, and was recognised as an engineer of exceptional ability. Two years ago he succeeded his father in the position of manager of the engineering department, and gave promise of a highly-successful professional career.

NEW COMPANIES.

THE CLYDE TURBINE SYNDICATE, LIMITED.—Capital £5,000.

GASOL ENGINEERING COMPANY, LIMITED.—Capital £500 in £1 shares.

HUGH WILSON, LIMITED. — Capital £2,000, to carry on the business of ironfounders, etc.

WOOD, FOXWELL & COMPANY, LIMITED.—Capital £3,000, to carry on business of engineers, etc.

ECONOMIC BOILER COMPANY, LIMITED.—Capital £10,000, to adopt an agreement with J. Francis.

MIDDLETON & BARKER, LIMITED.—Capital £7,050, to carry on the business of mechanical engineers, etc.

BRITISH WESTINGHOUSE ENGINEERS' CLUB, LIMITED.—Capital £500. Registered office: Trafford Park, Manchester.

REGENT ENGINEERING COMPANY, LIMITED.—Capital £2,000, to acquire the business of F. J. Cox, 104, Park Street, N.W.

CHELMSFORD FOUNDRY COMPANY, LIMITED.—Capital £1,500 in £1 shares. Registered office: 113, London Road, Chelmsford.

PETER BROTHERHOOD, LIMITED. — Capital £180,000, to acquire the business of engineers, etc., carried on as Peter Brotherhood.

R. C. FARRELL & COMPANY, LIMITED.—Capital £1,000, to carry on the business of civil engineers, measurers, ironfounders, etc.

HODGSON & STEAD, LIMITED.—Capital £30,000, to take over the business carried on at Egerton Iron Works, Salford, as Hodgson & Stead.

THOMAS ASHWORTH & COMPANY, LIMITED.—Capital £3,000, to acquire the business carried on by E. Ashworth, at Vulcan Iron Works, Burnley.

HUNTER & ENGLISH, LIMITED.—Capital £8,000, to take over the business of an engineer, etc., formerly carried on by S. H. Hunter, 202, Bow Road, Bow, E.

F. M. RUSSELL & COMPANY, LIMITED —Capital £20,000, to acquire the engineering business of F. M. Russell & Company, Junction Works, Willesden, N.W.

PETRIE & COMPANY, LIMITED.—Capital £25,000, to take over the business of engineers carried on by Petrie & Company, Limited, Whitehall Street, Rochdale.

ORTON MANUFACTURING COMPANY, LIMITED.—Capital £10,000, to carry on business of founders, engineers, etc. Registered office: 95, Great Eastern Street, E.C.

WALTHAM IRON WORKS, LIMITED.—Capital £100, to adopt an agreement between C. E. Peczenik & Foundries, Limited. Registered office: 11, Pancras Lane, E.C.

CROFT & PERKINS, LIMITED.—Capital £100,000, to carry on the business of mechanical engineers, etc. Registered office: Great Northern Works, Thornbury, Bradford.

H. SAMPSON & SONS, LIMITED.—Capital £25,000, to take over the business carried on at the Malago Vale Iron Works, Bedminster, Bristol, by H. Sampson & Sons.

MERSEY MACHINERY COMPANY, LIMITED.—Capital £1,500, to act as selling agents for the Neville Machine and Tool Company, Limited. Registered office: 7, James Street, Liverpool.

FIRTH, BLAKELEY, SONS & COMPANY, LIMITED.—Capital £15,000, to acquire the business of engineers carried on by Messrs. J. Firth, Blakeley, & Company, Thornhill Lees, Dewsbury.

JOHN BOWMAN & COMPANY, LIMITED.—Capital £8,000, to acquire the engineering works in Millikenpark, Renfrewshire, of John Bowman. Registered office: 95, Waterloo Street, Glasgow.

T. TOWARD & COMPANY, LIMITED.—Capital £18,000, to take over the business of engineers, etc., carried on by Messrs. T. Toward & W. Toward, at the St. Lawrence Iron Works, Ouseburn, Newcastle-on-Tyne.

WOODS & COMPANY (STOWMARKET), LIMITED.—Capital £20,000, to take over the business of engineers and ironfounders carried on by a company of the same name. Registered office: Bury Street, Stowmarket.

EDWARD ANDERSON, SONS & COMPANY, LIMITED.—Capital £2,000, to take over the business of consulting engineer, ironfounder, etc., carried on by E. Anderson. Registered office: 143, Cannon Street, E.C.

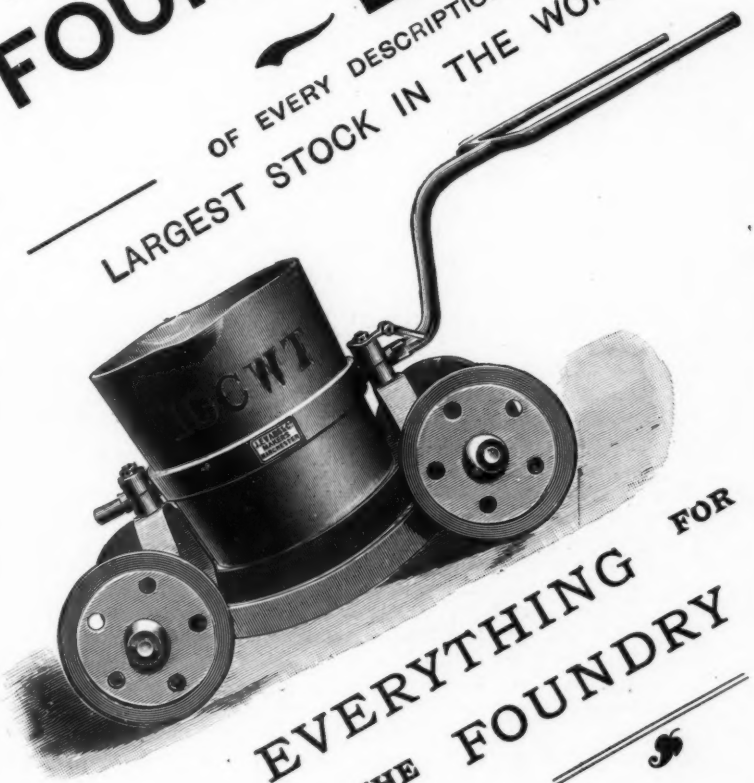
G. D. FOSTER & COMPANY, LIMITED.—Capital £2,000, to acquire the business of G. D. Foster & Company, and to carry on the business of stampers, founders, etc. Registered office: Empire Works, Mole Steet, Sparkbrook, Birmingham.

Contractors to H.M. Government.

FOUNDRY LADLES

OF EVERY DESCRIPTION.

LARGEST STOCK IN THE WORLD.



EVERYTHING FOR THE FOUNDRY

JAMES EVANS & CO.,

Telegrams:
"LADLES, MANCHESTER."
"BLACKINGS, GLASGOW."

BRITANNIA WORKS, MANCHESTER.

PERSONAL.

MR. G. ENNIS, J.P., has been elected a director of Measures Brothers, Limited.

THE late Mr. T. M. Hewitt, iron-founder, of Bolton, left estate of the gross value of £4,930.

ESTATE valued at £47,077 9s. 1d. gross was left by Mr. F. H. Orme, a director of the National Gas Engine Company, Limited.

MR. J. C. BROWN, of Messrs. Roland Carr & Company, has been appointed London manager for W. H. Keys, West Bromwich.

THE late Mr. S. Lees, of H. Lees & Sons, Limited, Park Bridge Iron Works, Ashton-under-Lyne, left estate of the gross value of £162,576.

MR. ARTHUR JACOB has been appointed secretary of the British Aluminium Company, Limited, and Mr. A. J. Sharwood has been added to the Board.

MR. W. W. MARTIN, chief draughtsman of the Midland Iron Works, Donnington, of C. & W. Walker, Limited, has resigned owing to failing health.

THE value of the estate of the late Mr. S. J. Summerson, chairman and joint managing director of Thos. Summerson & Sons, Limited, is £22,016 gross.

MR. COCKRILL, of Messrs. Flannery, Baggallay & Johnson, has joined the staff of Messrs. Douglas & Younger, consulting engineers, 141, Fenchurch Street, E.C.

MR. G. J. BIRD and MR. F. J. MOORHOUSE, of the staff of Mr. R. Green, consulting engineer, Birmingham, have been appointed on the engineering staff of the Queensland Government railways.

MR. AXEL SAHLIN, of Julian Kennedy, Sahlin & Company, Limited, has sailed for India in connection with the appointment of his firm as engineers to the Tata Iron and Steel Company, Limited.

MR. C. WHEELDON, manager of the engineering department of Thos. Perry & Sons, Limited, Highfields Works, Bilston, has been elected a director of the concern. Mr. G. Lewis succeeds Mr. Wheeldon.

THE late Lord Nunburnholme, chairman of Earle's Shipbuilding and Engineering Company, Limited, and a partner in Messrs. Amos & Smith, engineers and iron and brass founders, left estate of the gross value of £988,386.

MR. JAMES TANGYE, one of the founders of the original firm of James Tangye & Brothers, machinists, 40, Mount Street, Birmingham, which firm afterwards became Tangye Brothers, and then Tangyes, Limited, is very seriously ill.

MR. ROBERT MATTHEWS, of Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, Openshaw, Manchester, has just been elected for the second time as the President of the Manchester District Engineering Trades' Employers' Association.

THE officials of the Foundry Department of Cochrane & Company, Limited, Middlesbrough, met together at the offices of the firm recently for the purpose of asking their works manager, Mr. J. T. Goodwin, to accept a case of silver table ware as a memento of their good wishes on the occasion of his marriage. The chair was occupied by Mr. H. A. Taylor, who spoke of Mr. Goodwin's valuable services as engineer during the remodelling of the extensive plant, and organising new and more up-to-date systems since his advent to the works two years ago. Mr. Goodwin made a suitable and appreciative acknowledgment.

Ganister, Cupola Blocks, Fire Bricks,
Fire Clay.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
Steel Moulders' Composition, Silica Cement.

J. GRAYSON LOWOOD & Co., Ltd.,
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

PATENT

ALUMINO THERMIT WELDING

THERMIC PROCESS

REG. TRADE MARK.

— FOR —

BROKEN CASTINGS.

REPAIR SHOP

NOW OPEN.

ESTIMATES for WORK and ILLUSTRATED PAMPHLET upon application to

THERMIT LIMITED,

27, MARTIN'S LANE, CANNON STREET, E.C.

ELDERS FOUNDRY COKE

As supplied to the British . . Admiralty Dockyards.

The following, selected from numerous letters, are eminent testimony as to the quality of our celebrated "A.A.A." Coppee Foundry Coke, carefully selected, and despatched in sheeted wagons.

From PECKETT & SONS, Bristol.

Bristol, October 25th, 1904.

We have been using your Selected Foundry Coke for some considerable time.

We have pleasure in stating that we are very pleased with it, as we find we get sounder and cleaner castings, more free from blow-holes and other defects, than we formerly did.

From MOUNTFORT PHILLIPS & Co., Llantrissant.

Llantrissant, October 25th, 1904.

In reference to the Foundry Coke you have been supplying us with for the last six months, we have very great pleasure in letting you know that it has given every satisfaction, and that our Works Manager and Workmen give it the highest praise.

Elders Navigation Collieries, LTD. Cardiff.

PRICES OF METALS.

The following table shows the approximate latest prices and position of stocks of metals during the past two years :—

Metals.	1907-8.	1906-7.
Iron—Scotch pig warrants ... ton	*56/3	*63/6
—Middlesbro' warrants ... ... ton	48/8	56/6
—W.C. M/nos Bessemer ... ... ton	60/6	81/0
—Stock, Scotch, Feb. 6 ... tons	1,129	9,100
Copper—Chili bars, GMB ... ... ton	£61 10/0	£107 17/6
—Stock, Europe & afloat... ... tons	20,660	13,991
Tin—English ingots ton	£133 10/0	£195 15/0
—Straits ... ton	£130 5/0	£193 5/0
—Stock, Ldn. Hlnd and afloat ... tons	15,330	14,165
Lead—English pig ton	£15 2/6	£20 0/0
Spelter—Ord. Silesian ... ... ton	£20 5/0	£25 17/6
Quicksilver-(75lb.) bottle	£8 4/6	£7 0/0
Antimony—Regulus ... ... ton	£36 10/0	£107 10/0

*Settlement price.

Castings.

In the Cleveland district the following are the nominal rates current for castings :—

	£ s. d.		£ s. d.
Columns (plain)	6 15 0	to	7 0 0
Pipes, 1¼ to 2½ in.	5 2 6	to	5 7 6
,, 3 to 4 in.	4 15 0	to	5 5 0
,, 5 to 8 in.	4 12 6	to	4 15 0
,, 10 to 16 in.	4 12 6	to	4 15 0
,, 18 to 24 in....	4 12 6	to	4 15 0
Chairs	3 12 6	to	3 15 0
Floor plates (open sand)	2 17 6	to	3 0 0

Scrap.

The quotations for scrap, subject to market fluctuations, are as follows:—Heavy wrought (mixed), £2 10s. 0d.; light wrought, £1 7s. 6d.; heavy cast, £2 7s. 6d.; all per ton f.o.b., London. Copper (clean), £57 0s. 0d.; brass (clean), £41 0s. 0d.; lead (usual draft), £14 0s. 0d.; tea lead, £12 5s. 0d.; zinc, £16 0s. 0d.; all per ton delivered merchant's yard.

SILICA FIRE BRICK Co.,

OUGHTIBRIDGE.

GROUND GANISTER,

Wet or Dry.

Silco Cupola Bricks, 90 % Silica.

Better than Fire-clay Bricks for Cupolas.

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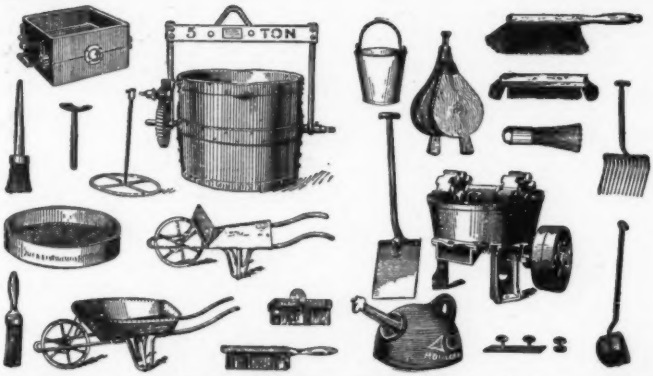

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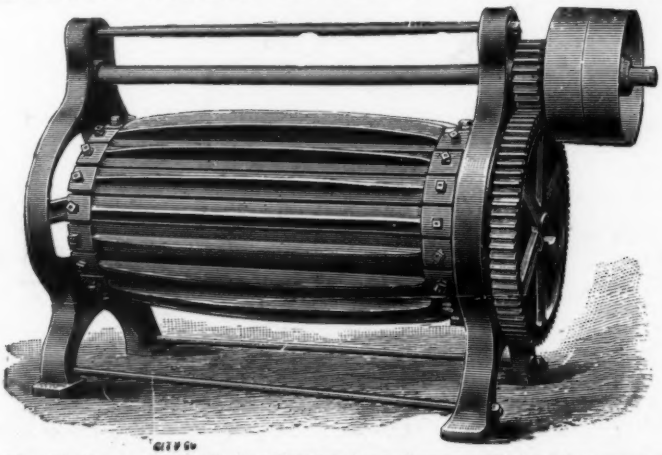

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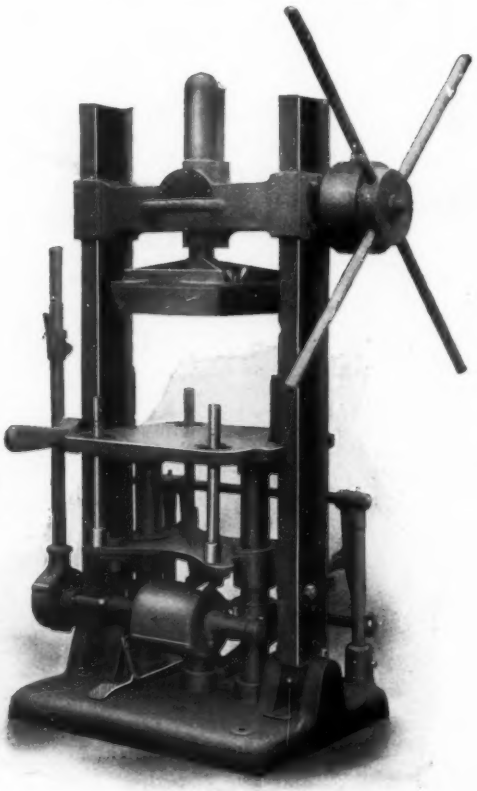

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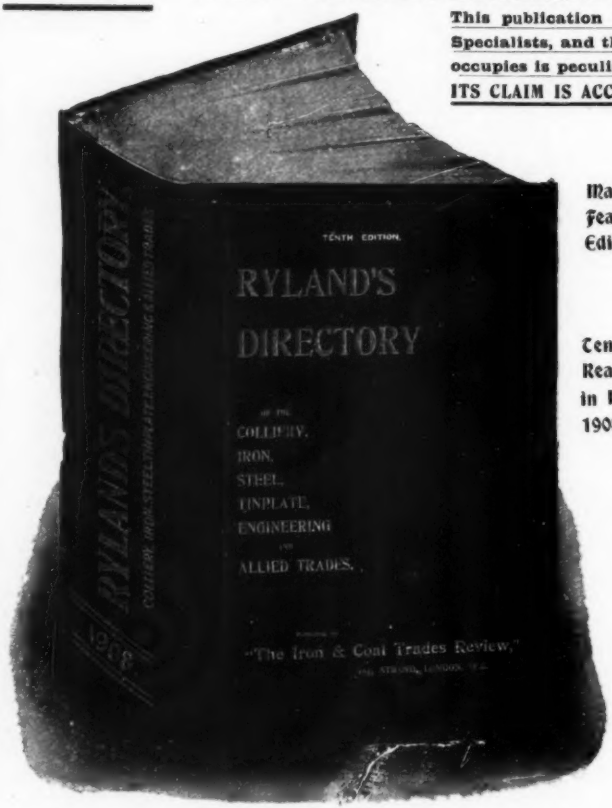

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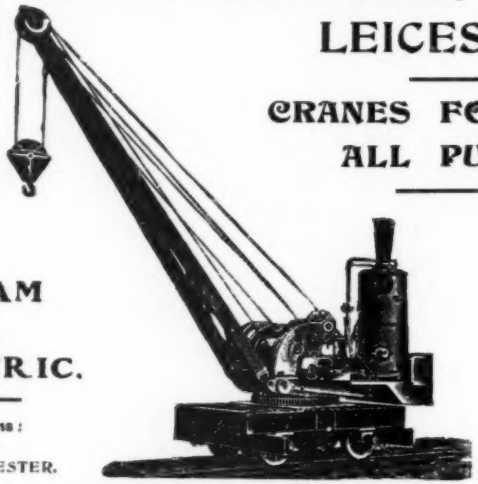

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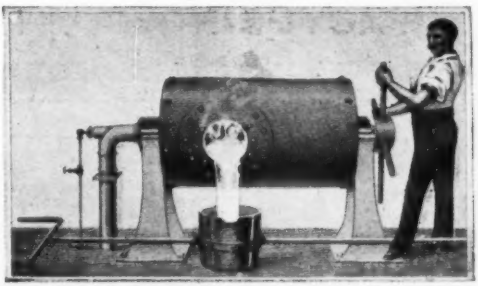

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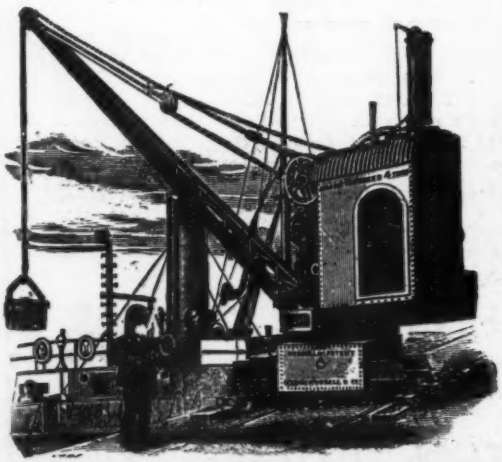

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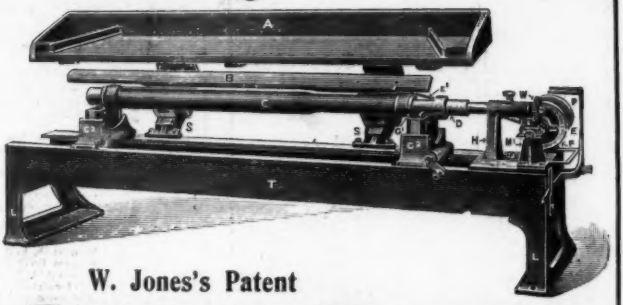

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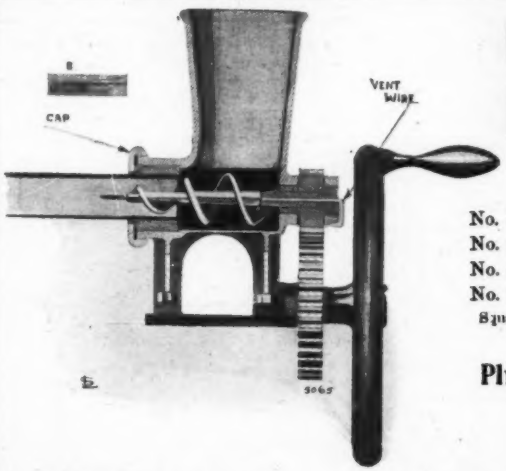

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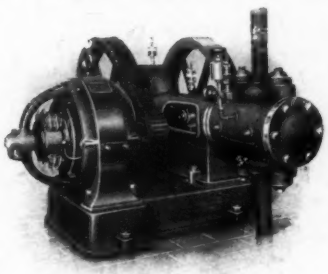

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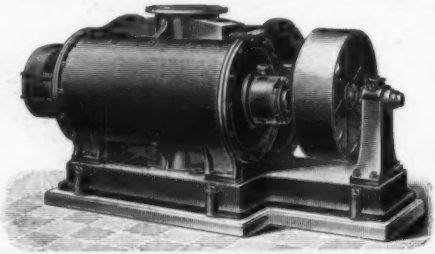

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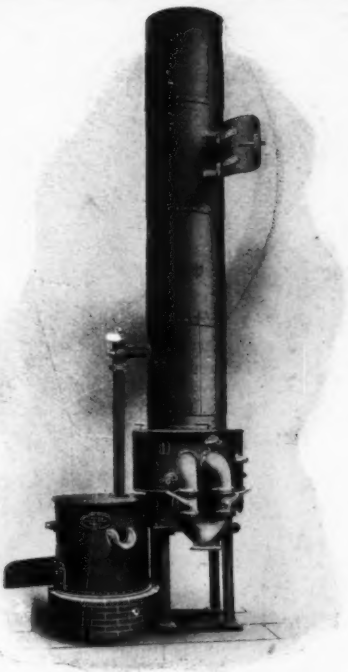

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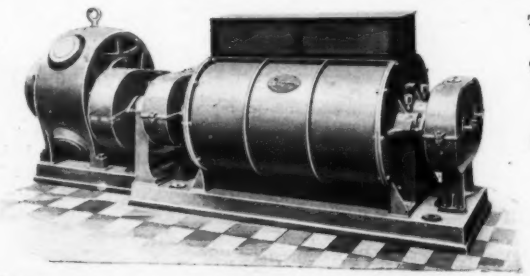

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